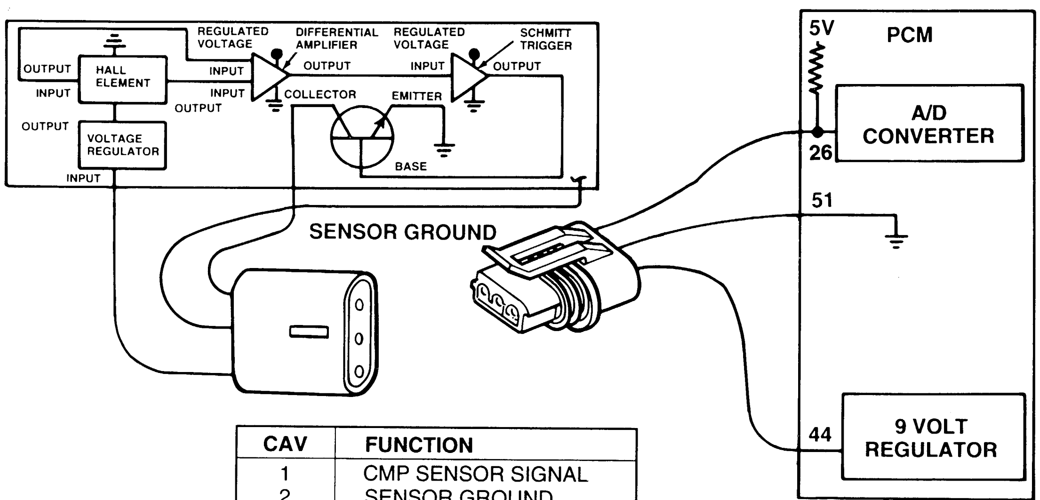
1995 Eagle Talon

2.0L DOHC Non-Turbo

Fuel, Ignition, and Emission Systems



CAV	FUNCTION
1	CMP SENSOR SIGNAL
2	SENSOR GROUND
3	9-VOLT SUPPLY

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Student Reference Book

SAFETY NOTICE

This publications purpose is to provide Technical Training information to individuals in the automotive trade. All test and repair procedures must be performed in accordance with manufacturers service and diagnostic manuals. All ***warnings, cautions,*** and ***notes*** must be observed for safety reasons. The following is a list of general guidelines:

- Proper service and repair is critical to the safe, reliable operation of all motor vehicles.
- The information in this publication has been developed for service personnel, and can help when diagnosing and performing vehicle repairs.
- Some service procedures require the use of special tools. These special tools must be used as recommended throughout this Technical Training Publication, the Diagnostic Manual, and the Service Manual.
- Special attention should be exercised when working with spring-or tension-loaded fasteners and devices such as E-Clips, Cir-clips, Snap rings, etc., careless removal may cause personal injury.
- Always wear safety goggles when working on vehicles or vehicle components.
- Improper service methods may damage the vehicle or render it unsafe.
- Observe all ***warnings*** to avoid the risk of personal injury.
- Observe all ***cautions*** to avoid damage to equipment and vehicle.
- ***Notes*** are intended to add clarity and should help make your job easier.

Cautions and ***Warnings*** cover only the situations and procedures Chrysler Corporation has encountered and recommended. Chrysler Corporation can not know, evaluate, and advise the service trade of all conceivable ways in which service may be performed, or of the possible hazards of each. Consequently, Chrysler Corporation has not undertaken any such broad service review. Accordingly, anyone who uses a service procedure or tool that is not recommended in this publication, must be certain that neither personal safety, nor vehicle safety, is jeopardized by the service methods they select.

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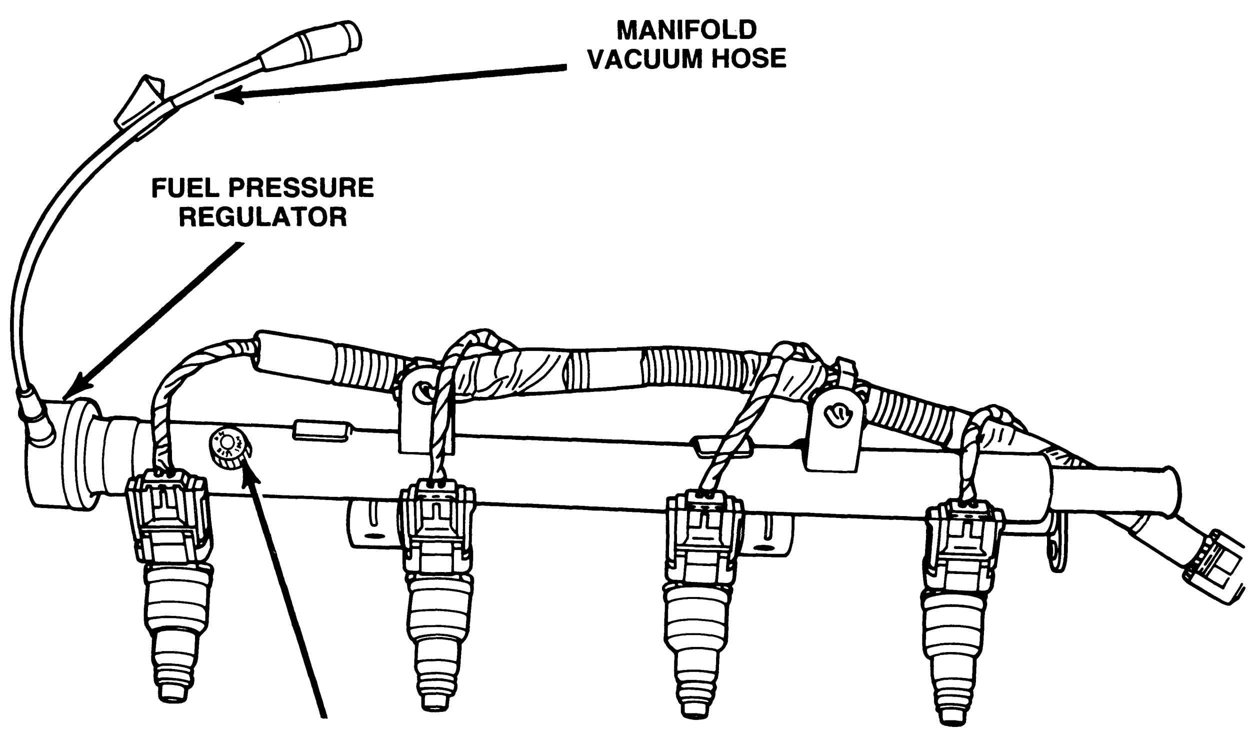
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2.0L DOHC Non-Turbo Fuel & Ignition

2.0L DOHC Non-Turbo Fuel & Ignition

TABLE OF CONTENTS

2.0L DOHC Non-Turbo Fuel & Ignition

2.0L DOHC Non-Turbo Fuel & Ignition

INTRODUCTION

Student Learning Objectives

After completing this course, the technician will be able to:

- Identify and locate the following Fuel and Emissions components-

  — A/C Sense Circuit
  — A/C Relay
  — ASD Relay
  — Battery Temperature Sensor (BTS)
  — Brake Switch
  — Camshaft Position Sensor (CMP)
  — Catalytic Converter
  — Condenser Fan Relays
  — Crankshaft Position Sensor (CKP)
  — Data Link Connector (DLC)
  — Duty Cycle Purge Solenoid (DCP)
  — EGR Valve and Solenoid
  — Engine Coolant Temperature Sensor (ECT)
  — Evaporative Canister
  — Fuel Cutoff Valve
  — Fuel Injectors
  — Fuel Pressure Regulator
  — Fuel Filter
  — Fuel Pump
  — Fuel Pump Relay
  — Fuel Rail
  — Generator
  — Idle Air Control Motor (IAC)
  — Ignition Coil
  — Inlet Temperature Sensor
  — Intake Air Temperature Sensor (IAT)
  — Knock Sensor (KS)
  — Malfunction Indicator Light (MIL)
  — Manifold Pressure Sensor (MAP)
  — Outlet Temperature Sensor
  — Park/Neutral Switch
  — Power Steering Pressure Switch
  — Powertrain Control Module (PCM)
  — Secondary Air Injection Solenoid
  — Speed Control Relay
  — Speed Control Servo

- — Speed Control ON/OFF Switch
- — Speed Control COAST/SET - ACCEL/RES - CANCEL Switches
- — Starter Relay
- — Throttle Body
- — Throttle Position Sensor (TPS)
- — Transmission Control Module (TCM)
- — Upstream and Downstream Oxygen Sensors
- — Vehicle Speed Sensor (VSS)

- Identify which components from the previous list are PCM inputs or outputs.
- Identify whether a component is part of the emissions system, fuel system, ignition system, or a combination of systems.
- Recognize the signals generated by the Crankshaft and Camshaft Position sensors.

2.0L DOHC Non-Turbo Fuel & Ignition

General Description

This publication contains information on the 1995 Eagle Talon with the 2.0L DOHC Chrysler engine. Information regarding the 2.0L MMC turbocharged engine can be found in Publication 81-699-94085.

The fuel system for the Talon's 2.0L DOHC engine utilizes sequential multiport fuel injection to deliver precise amounts of fuel to the intake manifold. Fuel pressure is delivered by an in-tank pump module that includes an integral fuel level sending unit.

The 1995 Talon uses a direct ignition system, eliminating the need for a distributor. Ignition and fuel injector operation are controlled by a new Powertrain Control Module (PCM) that reviews inputs from a number of sensors. The PCM provides outputs to fuel and ignition system components to promote the most efficient operation possible.

For 1995, Talons' equipped with Chrysler's PCM and manual transaxles have a sophisticated emissions system diagnostic process (OBD II) to ensure that emissions meet federal clean air regulations. Any Talon equipped with the MMC 2.0L turbocharged engine will also have OBD II diagnostics (with MMC's ECM). Talons equipped with Chrysler's PCM and automatic transaxles will be offered with OBD I diagnostics, which were available on previously released Chrysler-manufactured vehicles.

FUEL SYSTEM COMPONENTS

Fuel Tank

The Talon's fuel tank is located at the rear of the vehicle (fig. 1), between the frame rails, under the rear seat floor. The tank is made of stamped steel, and has a capacity of 16 gallons.

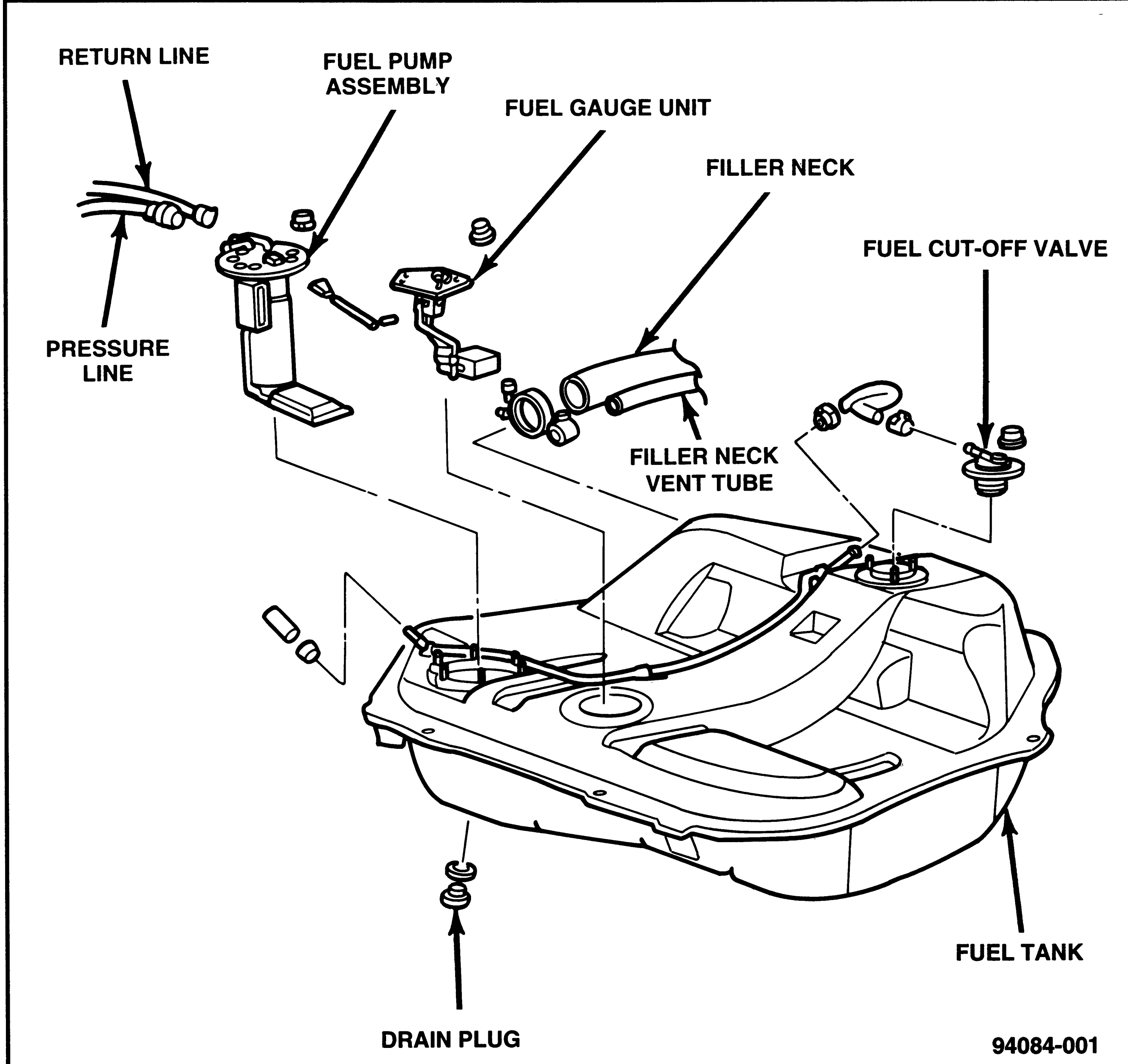


Figure 1 Fuel Tank and Components

Fuel Cutoff Valve

The fuel tank is equipped with a fuel cutoff valve to prevent fuel from entering the evaporative canister when the vehicle fuel tank is overfilled or when the vehicle moves around sharp corners and the fuel sloshes up to the valve. The valve also prevents fuel from leaving the fuel tank through the evaporative canister hose if the vehicle overturns.

During normal operation, the weight of the valve overpowers the force of the spring, opening the passage for fuel vapor (fig. 2).

When the fuel level is high or when driving around sharp corners, the liquid fuel causes the float to rise, closing the port and preventing liquid fuel from entering the evaporative canister line (fig. 2).

If the vehicle overturns, gravitational pull on the float is great enough to overcome spring pressure and close the port, preventing any fuel spillage through the evaporative canister line.

In addition, if the float sticks, causing the valve to remain closed, there is a relief valve that provides a means through which fuel vapor can escape to the evaporative canister.

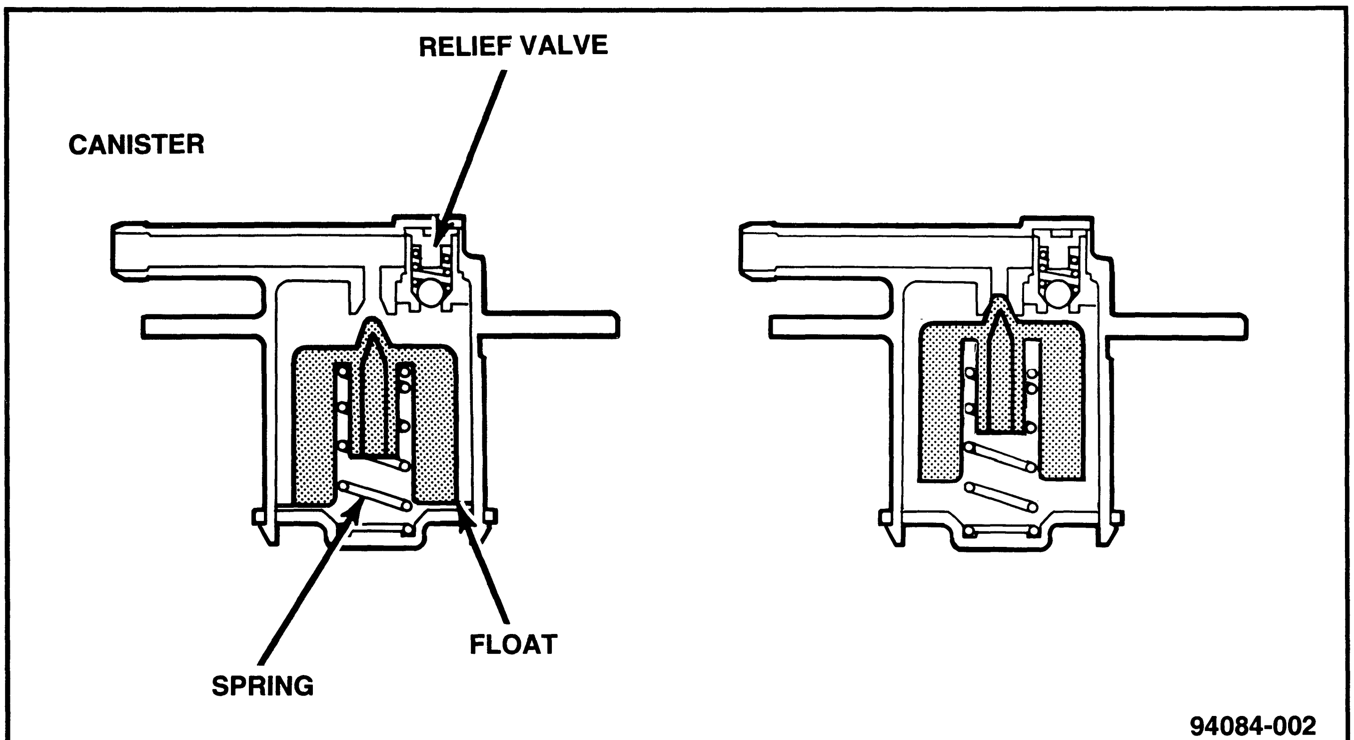


Figure 2 Fuel Cutoff Valve

Evaporative Control System

The evaporative control system consists of a fuel cap, fuel cutoff valve, vapor line, fuel tank pressure relief valve, evaporative canister, duty cycle purge solenoid, orifice, and an intake manifold vacuum line (fig. 3).

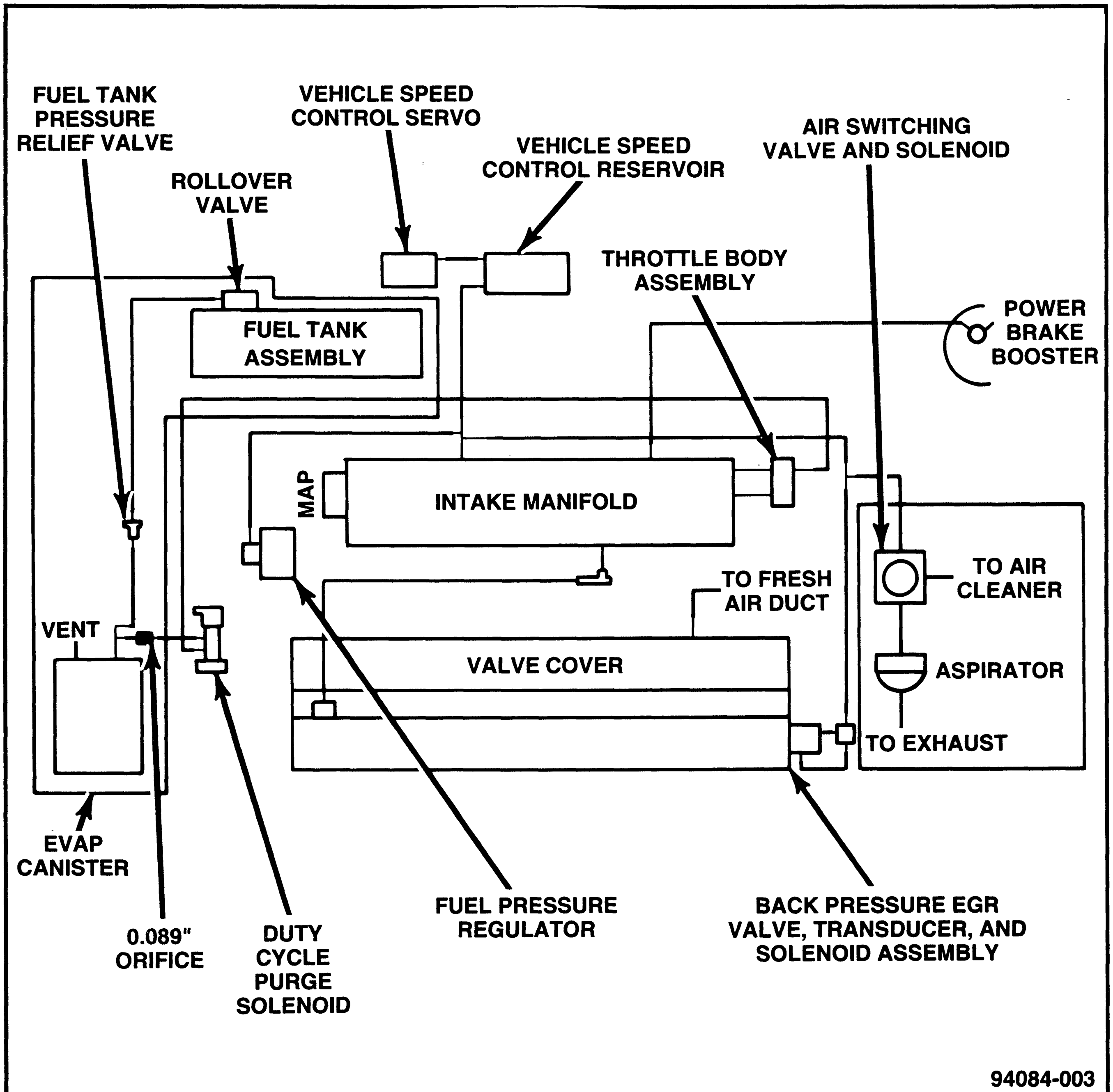


Figure 3 Evaporative Control System

The fuel filler cap is equipped with a screw-on lock mechanism (fig. 4). The cap is designed to increase impact resistance in a collision. Even if the lug on the cap is knocked off, the screw-on portion of the cap will remain on the filler neck. This improves safety, preventing fuel from leaking out even if the vehicle overturns in an accident. In addition, a ratchet mechanism has been added to the filler cap lug to keep the tightening force on the filler cap constant. Also, the cap is equipped with a valve to relieve pressure extremes in the fuel tank.

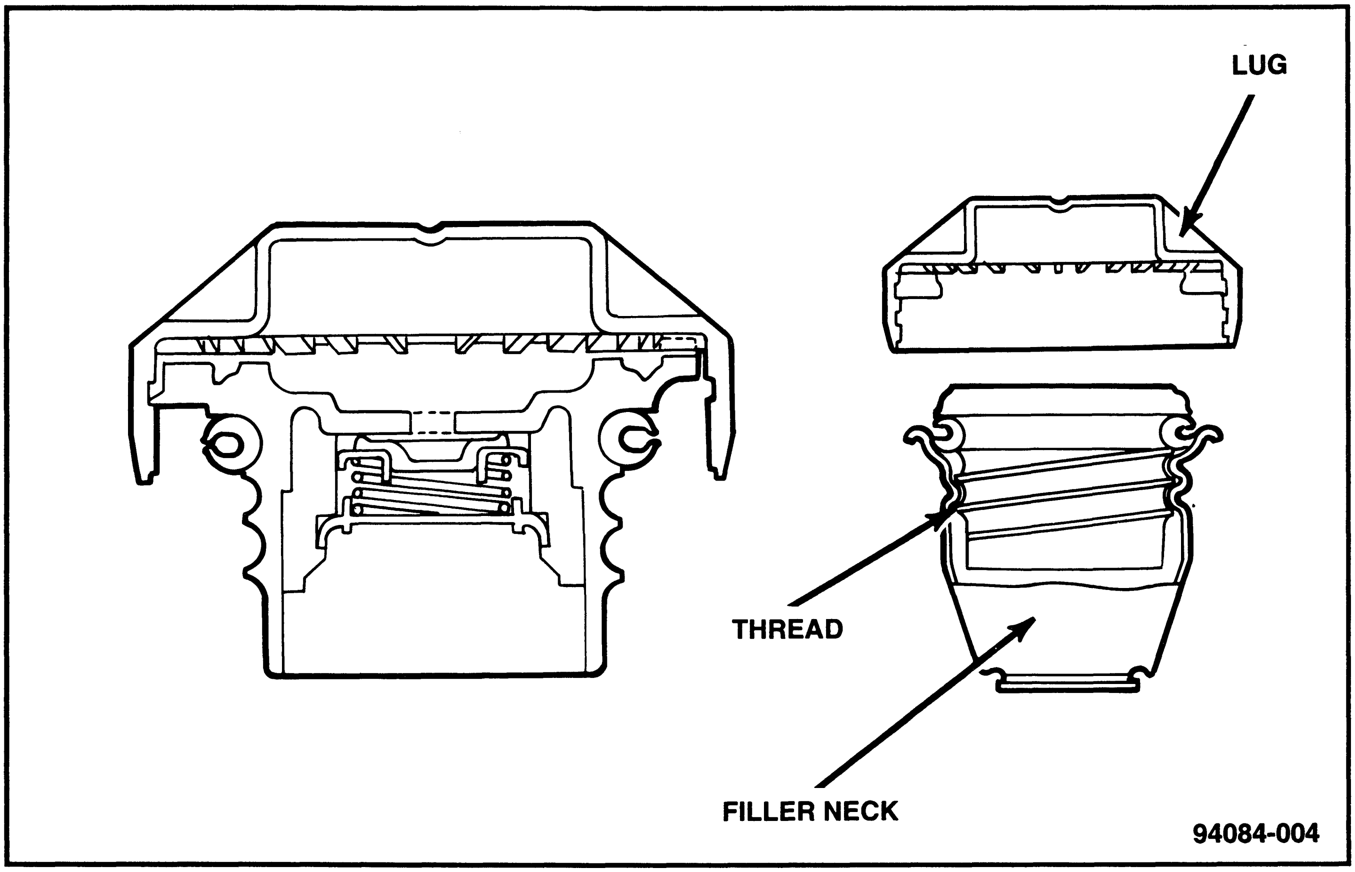


Figure 4 Fuel Filler Cap

The evaporative canister is mounted on a plastic bracket, behind the passenger side of the front fascia. It temporarily stores fuel vapors until intake manifold vacuum draws them into the combustion chamber.

Between the fuel cutoff valve and the evaporative canister is a fuel tank pressure relief valve. This valve incorporates a one-way check valve and an orifice. A restriction is applied only in the direction of flow from the fuel tank to the evaporative canister. The check valve allows the unrestricted flow of vapors in the opposite direction.

Mounted above the canister is a Duty Cycle Purge (DCP) solenoid used to control the flow of vapors to the intake manifold. Operation of the solenoid is controlled by the PCM through pin 16 of the 60-way connector (fig. 5), which provides a ground path that allows the solenoid to close, preventing vapor flow.

The PCM does not energize the solenoid during the cold-start warm-up period or during the hot-restart time delay. Once the vehicle enters closed loop operation and delay times have elapsed, the PCM energizes the solenoid approximately five to ten times per second, depending upon the throttle position, engine speed, and engine load. The PCM varies the pulse-width signal to the solenoid to control the amount of vapor flow.

An 0.089 in. orifice is located in the purge line from the DCP solenoid to the intake manifold. This orifice controls the volume of vapor flow to the intake manifold.
If the DCP solenoid fails electrically, the solenoid is designed to allow vapors to be purged continuously.

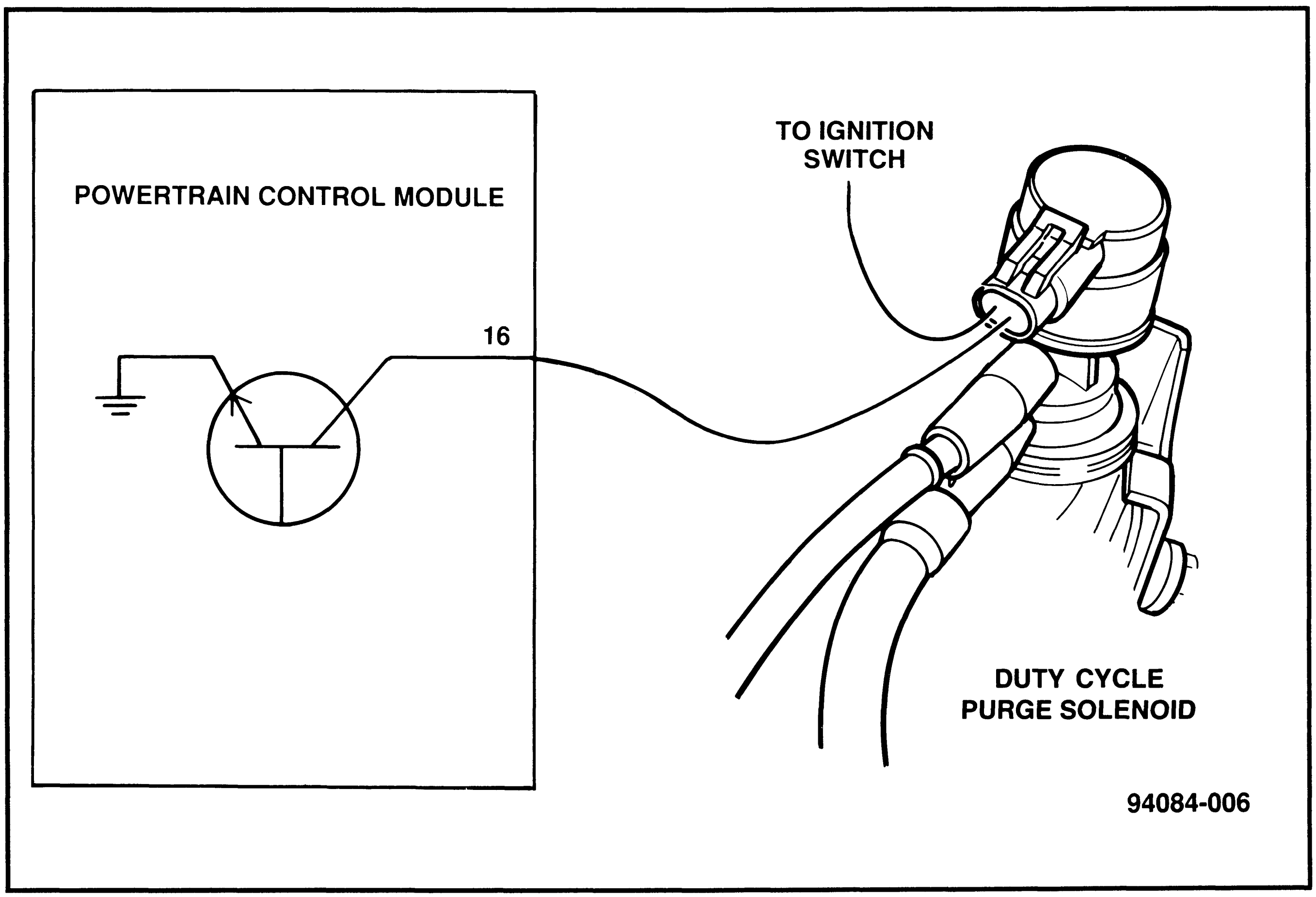


Figure 5 Duty Cycle Purge Solenoid Circuit

Fuel Pump Module

The Talon uses an in-tank fuel pump module (fig. 6). The fuel pump is mounted on top of the tank, and is accessed from a service port through the rear seat floor. The pump module uses an impeller pump, which is driven by a 12-volt DC motor. The motor is activated any time the fuel pump relay is energized. The pump contains a check valve on the outlet port that prevents fuel from returning to the tank through the pump when the pump is off. A fuel level sending unit is mounted separately on top of the tank.

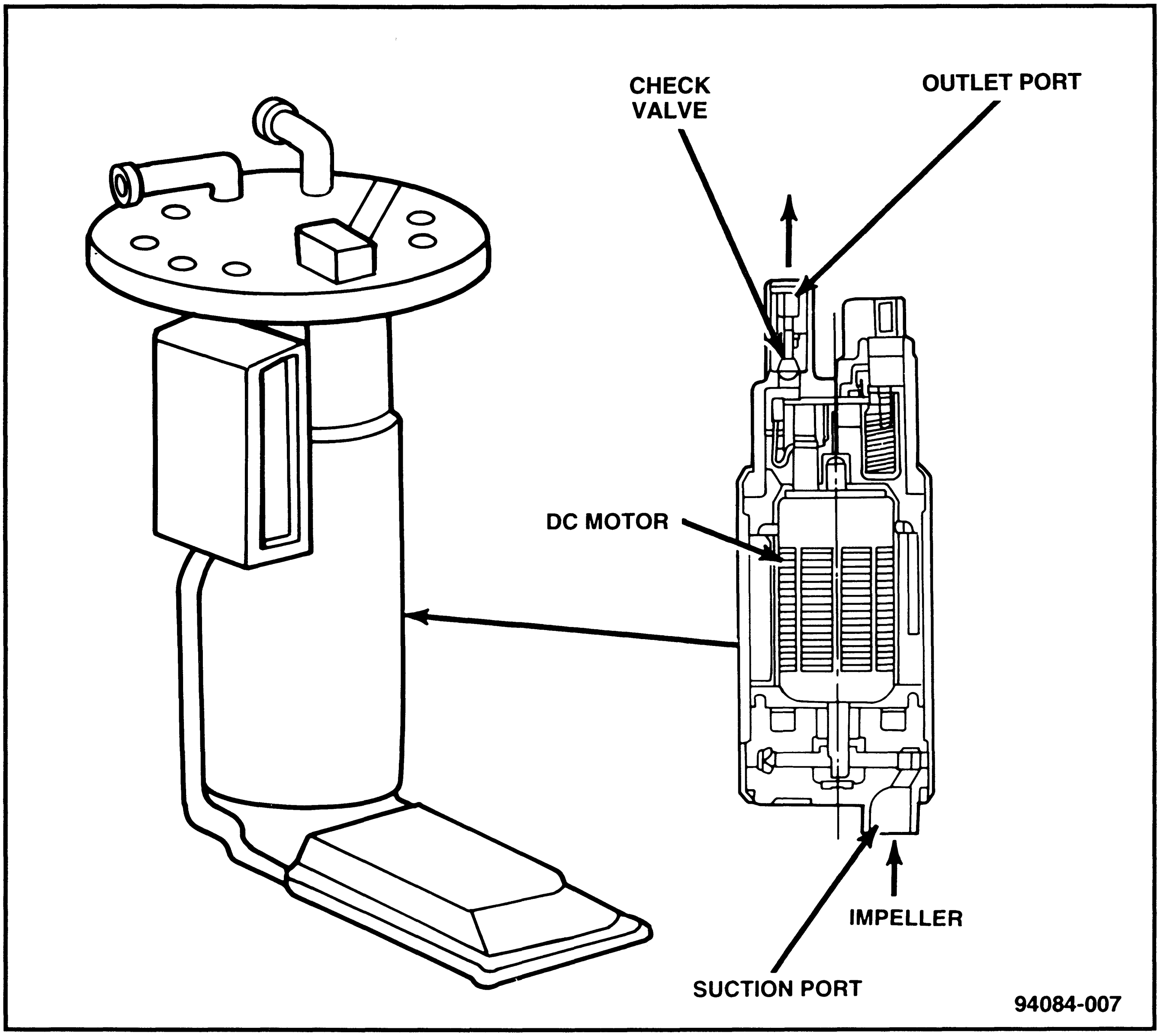


Figure 6 Fuel Pump Module

Fuel Filter

The fuel filter for the Talon (fig. 7) is mounted in the engine compartment, under the battery tray. The filter is fitted a with flare fitting on the pump side, and a banjo fitting on the fuel rail side. Banjo fittings are sealed between the fitting and the filter with a copper gasket. A hollow (eye) bolt with a drilled port and a copper gasket are used to attach the fitting to the filter.

Caution: *When replacing the filter, never reuse the copper gaskets, and always torque the fuel line eye bolt to 22 ft.-lbs.*

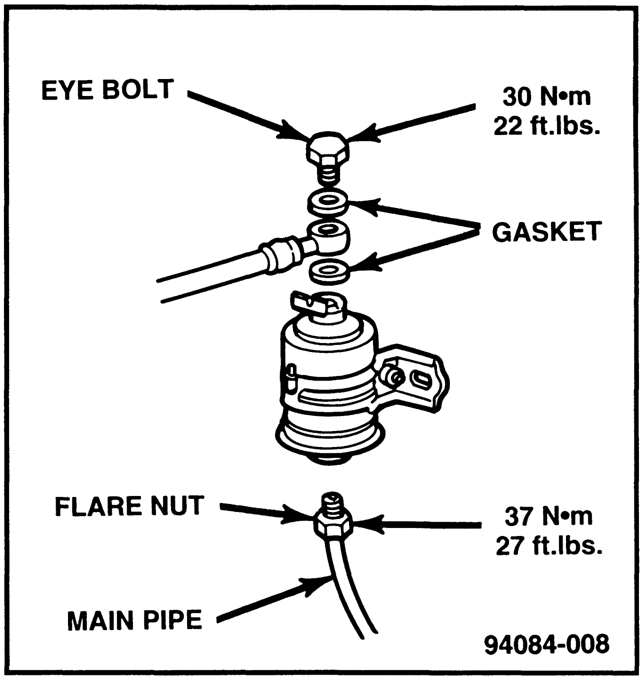


Figure 7 Fuel Filter

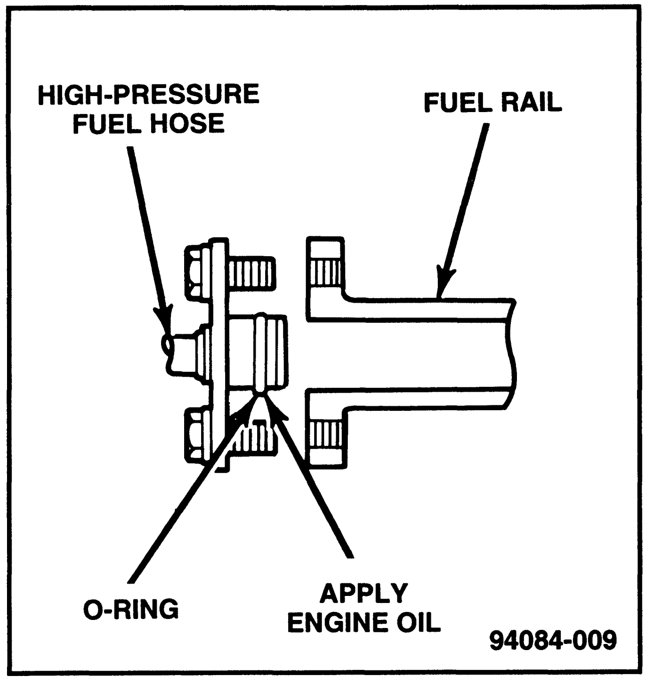


Figure 8 Hose Union

Fuel Lines

The high-pressure line from the tank to the filter is made of steel, except for a high-pressure flexible hose from the pump to the steel line. A high-pressure flexible rubber hose is used from the filter to the fuel rail. As mentioned earlier, the filter side of this hose is fitted with a banjo fitting. The fuel rail side of this hose is fitted with a hose union (fig. 8). The union is attached to the fuel rail by two attaching bolts, and is sealed by a single O-ring.

Caution: *When installing the high-pressure fuel line to the fuel rail, apply engine oil to the O-ring, then re-torque the union bolts to 4 ft.-lbs.*

Fuel Pressure Regulator

System pressure is maintained by the fuel pressure regulator which is mounted at the rearward end of the fuel rail (fig. 9). The regulator contains a calibrated spring and a diaphragm that actuates the regulator valve (fig. 10). Fuel pressure operates on one side of the diaphragm, while spring pressure and intake manifold vacuum operate on the other side (fig. 10). When the pump delivers fuel to the fuel rail, the diaphragm of the regulator opens the valve to the return line, allowing fuel to return to the fuel tank. The spring on the opposite side of the diaphragm attempts to close the valve, causing an increase of pressure on the fuel rail. The spring is calibrated to maintain **48 psi** of fuel pressure on the fuel rail.

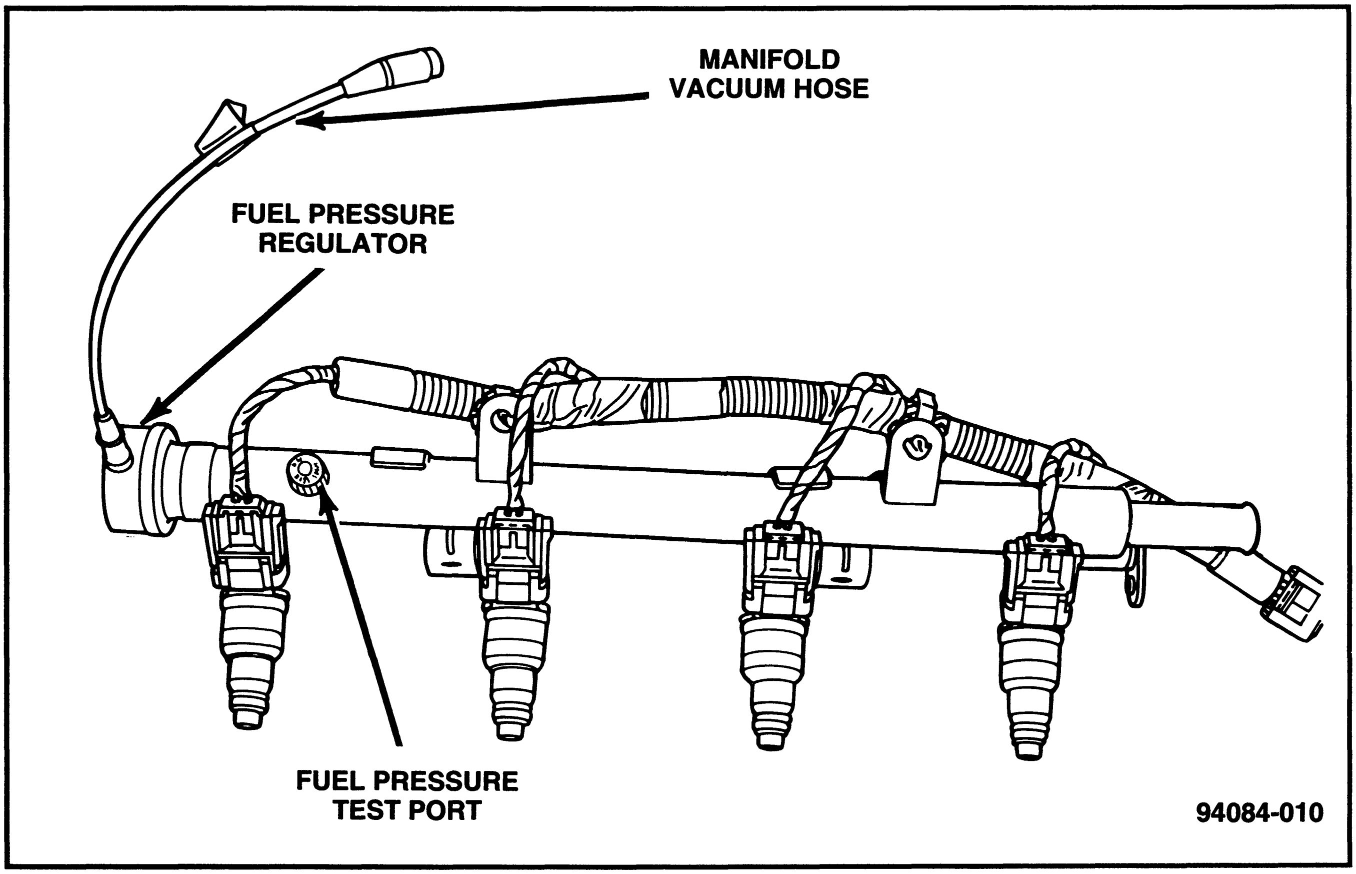


Figure 9 Fuel Rail

A fuel pressure test port is provided on the fuel rail (fig. 9) to enable fuel pressure testing with tool C-4799-1. The port can be used also to relieve fuel pressure from the rail in order to perform fuel system service. Tool C-4799-A is used to assist in relieving fuel pressure. Always follow the procedures in the Service Manual when removing fuel system components.

The fuel pressure regulator is connected also to intake manifold vacuum (fig.10). The connection to intake manifold vacuum is necessary to maintain a constant pressure differential of 48 psi between the fuel rail and the intake manifold. This pressure differential occurs across the injector. When manifold pressure decreases, the pressure at the tip of the injector also decreases. This decrease of pressure can cause the flow rate of the injector to change if fuel pressure does not change accordingly. For every pound of pressure change in the intake manifold, the regulator changes equally.

Example:

When intake manifold vacuum is at a steady 20 in. Hg (-10 psi), the regulator drops fuel pressure by 10 psi. Under these circumstances, fuel pressure read at the fuel rail will be close to 38 psi. By dropping the pressure to 38 psi, the pressure differential across the injector remains a constant 48 psi.

Math:

48 psi (regulator pressure)
-10 psi (20 in. Hg from the intake manifold)
38 psi (at the rail)

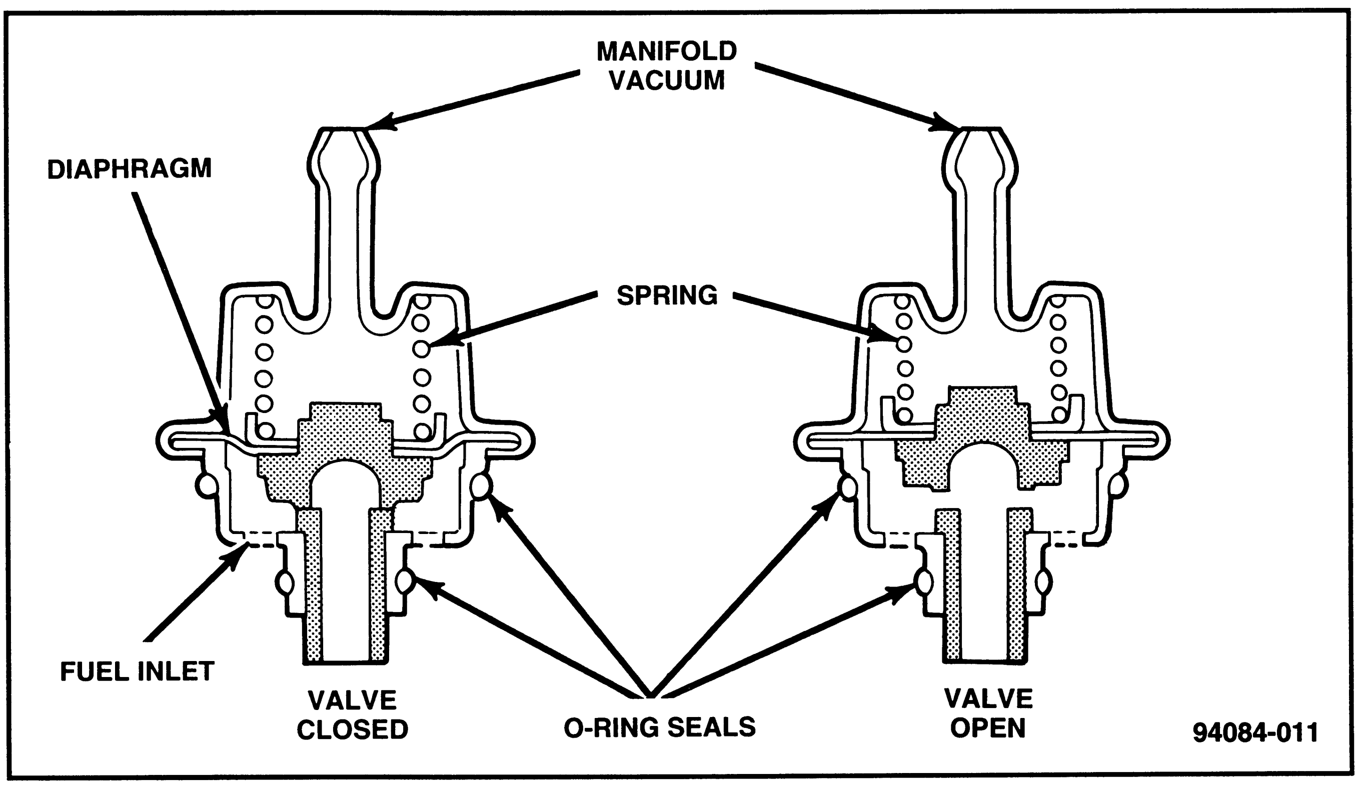


Figure 10 Fuel Pressure Regulator Operation

Warning: *Release fuel system pressure before servicing fuel system components. The procedure is described in the Service Manual. Service vehicles and fuel system components in well-ventilated areas and avoid sparks, flames, and other ignition sources. Never smoke while servicing the vehicle's fuel system.*

Fuel Injectors

The Talon uses top-feed fuel injectors (fig. 11). The injectors mount to the fuel rail with push-on retaining clips, and use O-rings to prevent leakage between the injectors and the fuel rail. The injectors have an impedance of 12 ohms and a flow rate of approximately 180 grams per minute (static flow). Fuel is dispersed through four openings at the bottom of each injector (fig. 11). This design allows for an atomized spray, similar to a pintle injector, but with the low cost and easy serviceability of a pencil-stream injector.

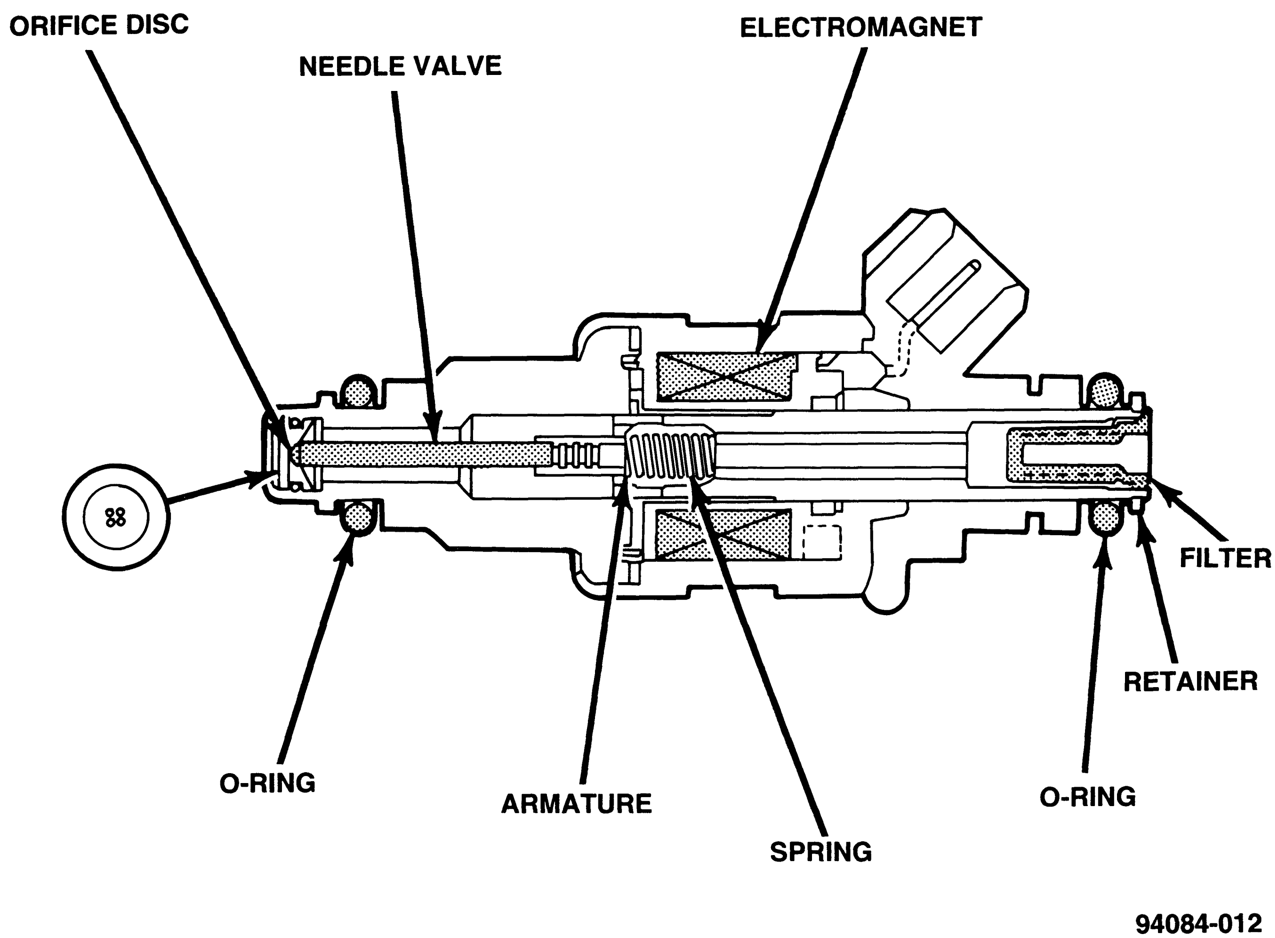


Figure 11 Fuel Injectors

AIR INLET SYSTEM

Intake Manifold

The throttle body, Manifold Absolute Pressure (MAP) sensor, Intake Air Temperature (IAT) sensor, Exhaust Gas Recirculation (EGR) tube, fuel pressure regulator vacuum hose, PCV valve vacuum line, and fuel injectors are mounted directly onto the manifold body (fig. 12). The purge line is connected to manifold vacuum at the throttle body (fig. 12).

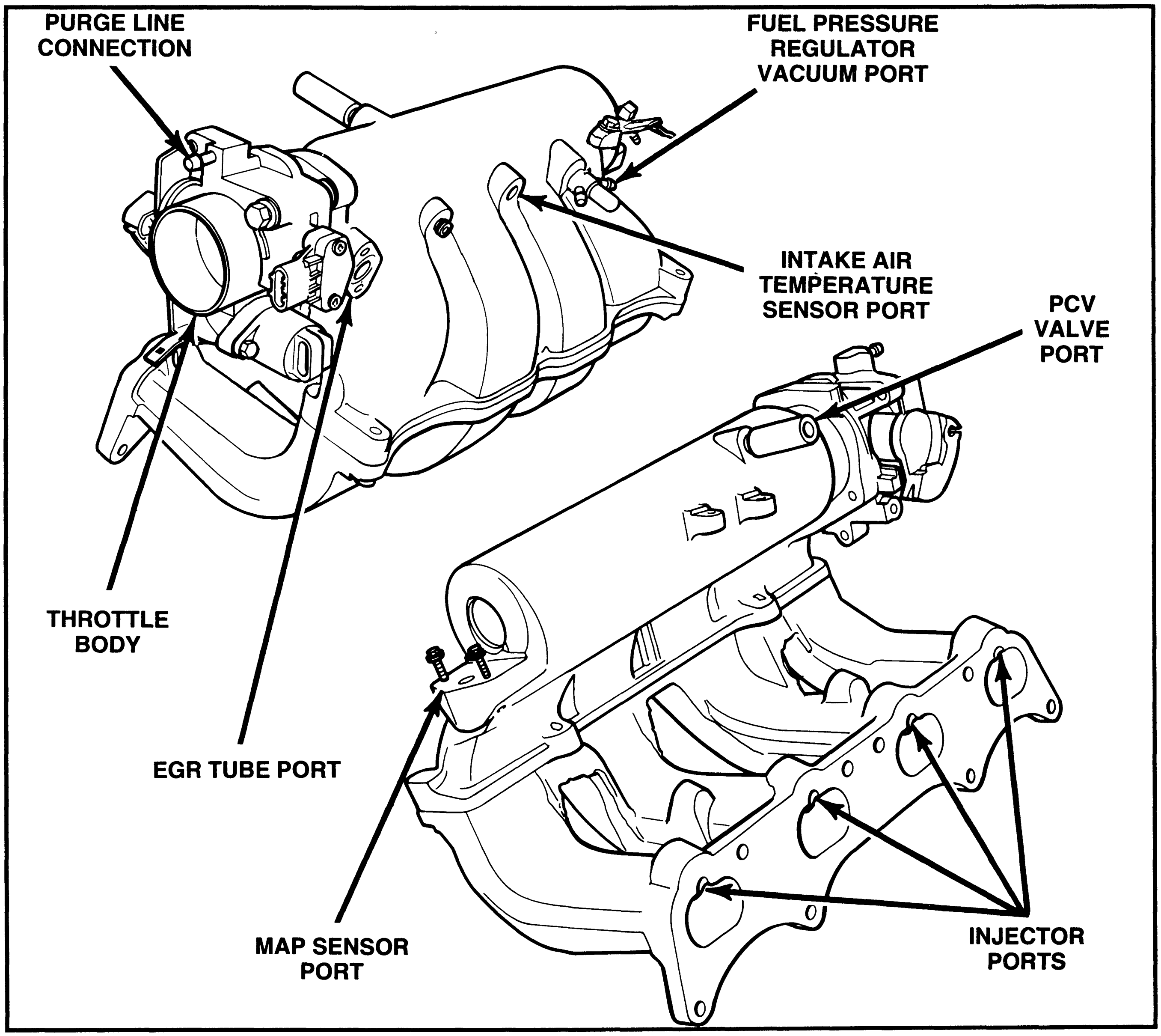


Figure 12 Intake Manifold

Throttle Body

The Talon uses a contoured-bore throttle body (fig. 13), which changes air velocity slightly with moderate accelerator pedal movement. This helps reduce buck and bobble at light throttle positions.

The Talon also uses an off-center (progressive) cam (fig. 14) to provide graduated operation of the throttle blade with moderate pedal movement at tip-in.

The Idle Air Control (IAC) motor and the Throttle Position Sensor (TPS) are attached to the throttle body (fig. 14).

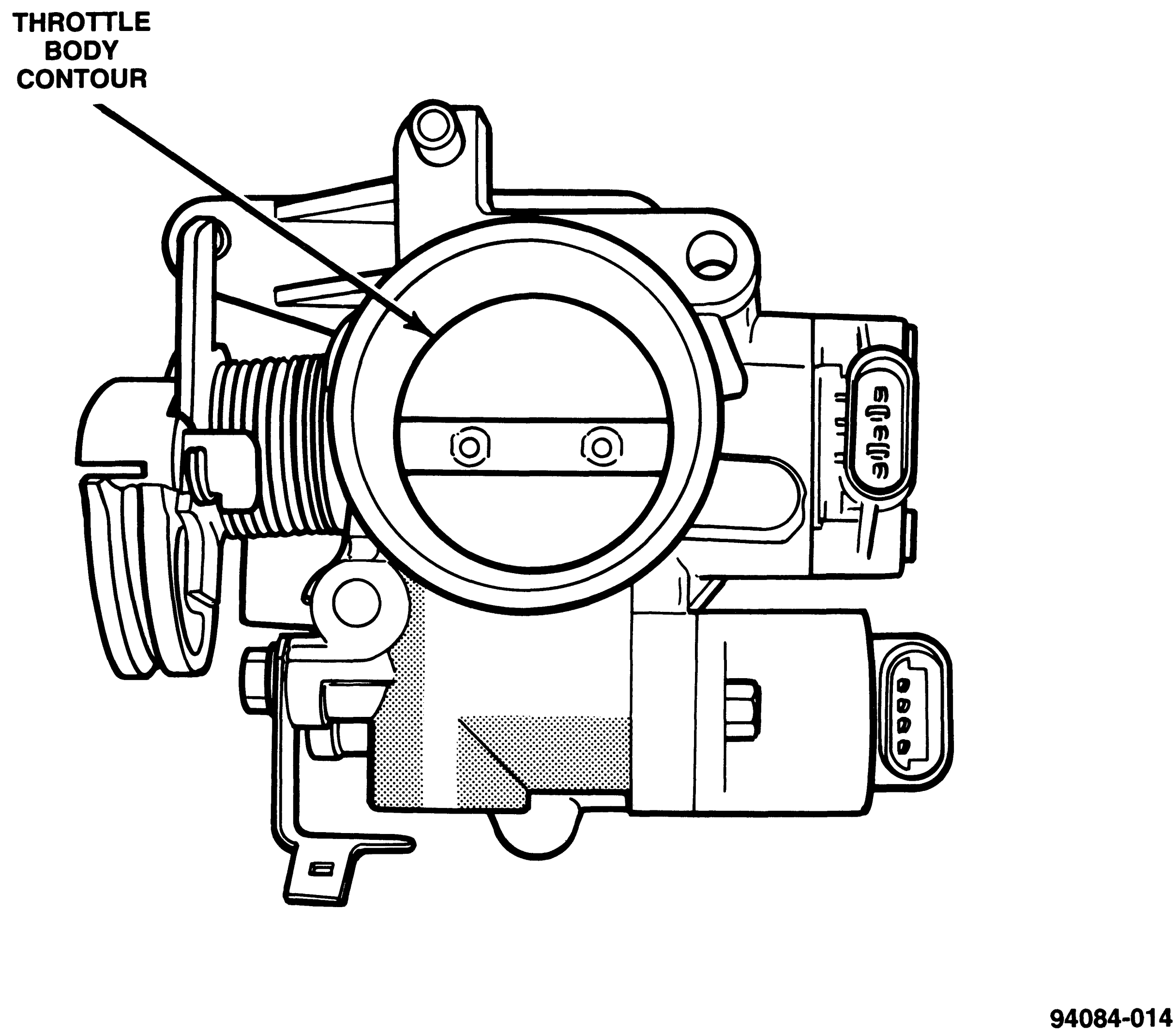


Figure 13 Throttle Body

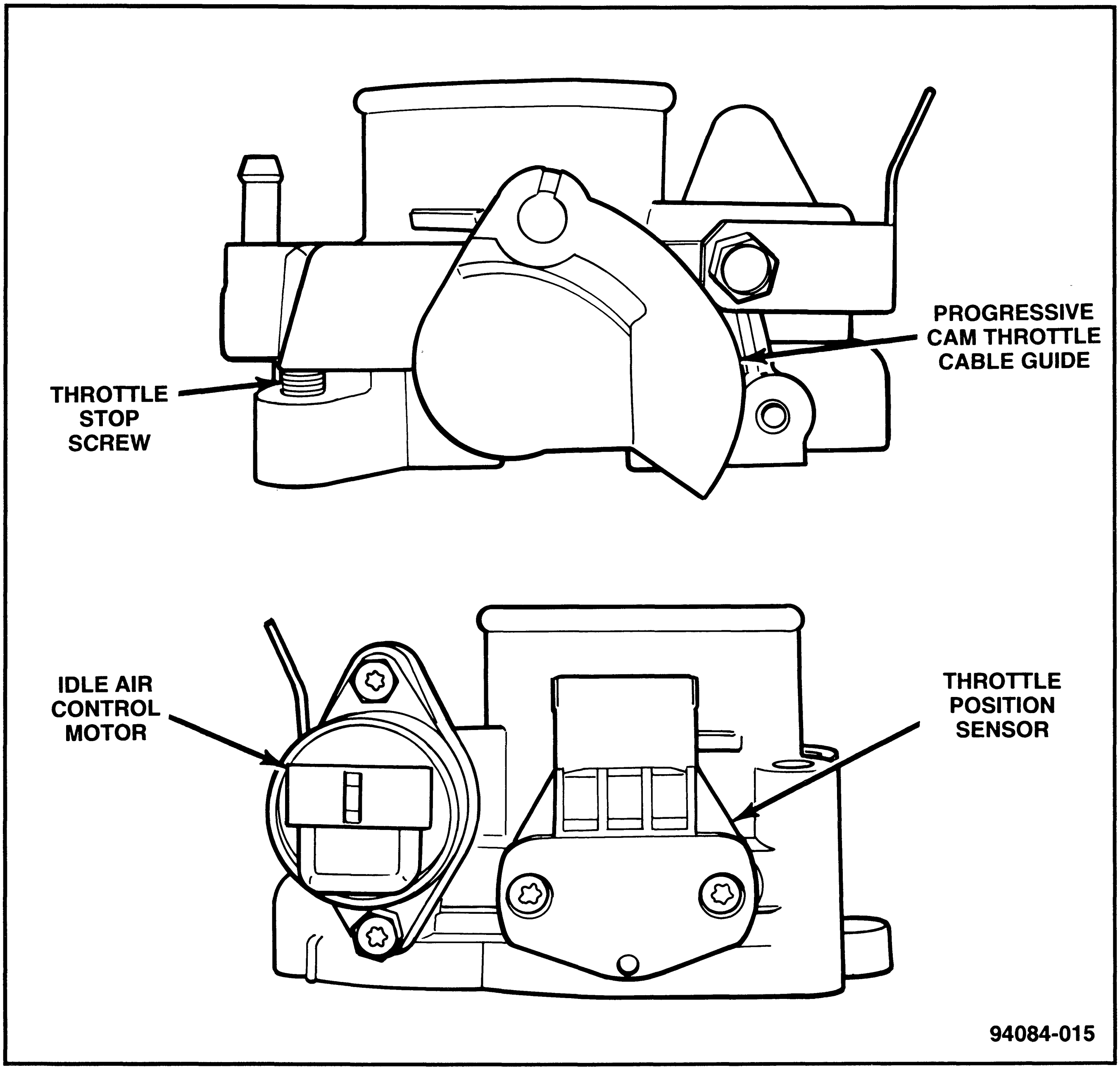


Figure 14 Throttle Body Components

Air Cleaner

The Talon uses a rectangular air cleaner assembly with a replaceable dry filter element. The two-piece housing is held together by spring-band clamps, and is mounted to the engine's throttle body. An air duct supplies outside air for the system.

IGNITION SYSTEM

Ignition Coil

The Talon uses a Direct Ignition System (DIS) with a single coil-pack mounted to the top of the engine (fig. 15). The pack contains two independent coils, one for each pair of cylinders. Coil 1 serves cylinders 1 and 4, and coil 2 serves cylinders 2 and 3. Each coil tower is labeled with the numbers of the cylinders it serves. The positioning of the coil allows the use of relatively short spark plug wires leading to each spark plug.

Each coil fires two spark plugs simultaneously in a series circuit. One cylinder is fired on the compression stroke, while its companion is fired on the exhaust stroke. The coil's polarity is; coil serving cylinders 1 and 4, 1 is positive and 4 is negative; coil serving cylinders 2 and 3, 2 is positive and 3 is negative. Resistance on the primary side of the coil should be between 0.51 and 0.61 ohms. The resistance of the secondary side is between 11,500 and 13,500 ohms. The coil pack has the ability to provide up to 40,000 volts, if needed.

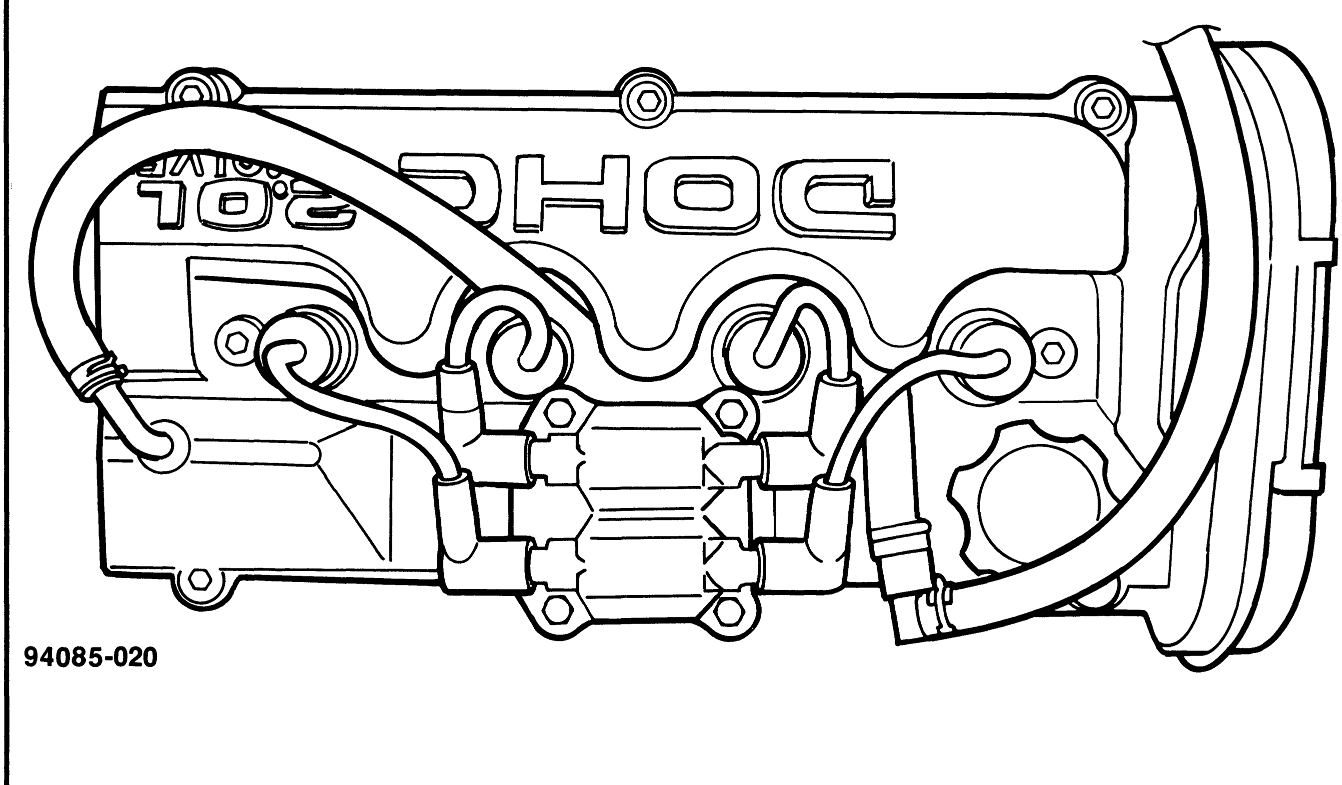


Figure 15 Ignition Coil

2.0L DOHC Non-Turbo Fuel & Ignition

Champion RC9YC resistor spark plugs are used on the 2.0L DOHC engine. The recommended spark plug gap is 0.035 in. The following is an explanation of the spark plug number:

R = Resistor
C = 14 mm, 3/4 in. reach, 5/8 in. hex
9 = Heat range
Y = Projected core nose
C = Copper-plus design

Spark plug wires are 8 mm in diameter, and are designed for increased conductivity, durability, and heat resistance. The spark plug boots are high-temperature resistant silicone, and extend into spark plug tubes.

Powertrain Control Module (PCM)

The Talon requires a unique PCM (fig. 16) to accommodate the enhanced on-board diagnostics for manual transaxle vehicles. The new controller is smaller than previous PCMs and requires no air flow for cooling. The controller is located on the driver's side inner fender, in the engine compartment (fig. 16).

The PCM controls operation of the fuel, ignition, emissions, charging, and speed control systems. It receives information from input sensors that monitor engine operating conditions. After processing the information, the PCM operates outputs that regulate engine performance. This cycle of input/processing/output ensures that the engine meets emissions, performance, fuel economy, and driveability requirements. The cycling also provides for diagnostic capabilities that surpass those of previous Chrysler vehicles.

The PCM controls operation of the ignition system by providing output voltage to the ignition coil through operation of the Automatic Shut Down (ASD) relay. Also, the PCM provides the coil's switched ground path. The PCM adjusts ignition timing to meet changing operating conditions, as determined by data received from several PCM inputs.

The PCM controls injector operation by providing battery voltage through the ASD relay, and ground for individual injectors. The PCM adjusts injector pulse width by varying the duration of the ground path provided to each injector. The PCM processes the data received from several inputs to determine the optimum injector pulse-width for each operating condition.

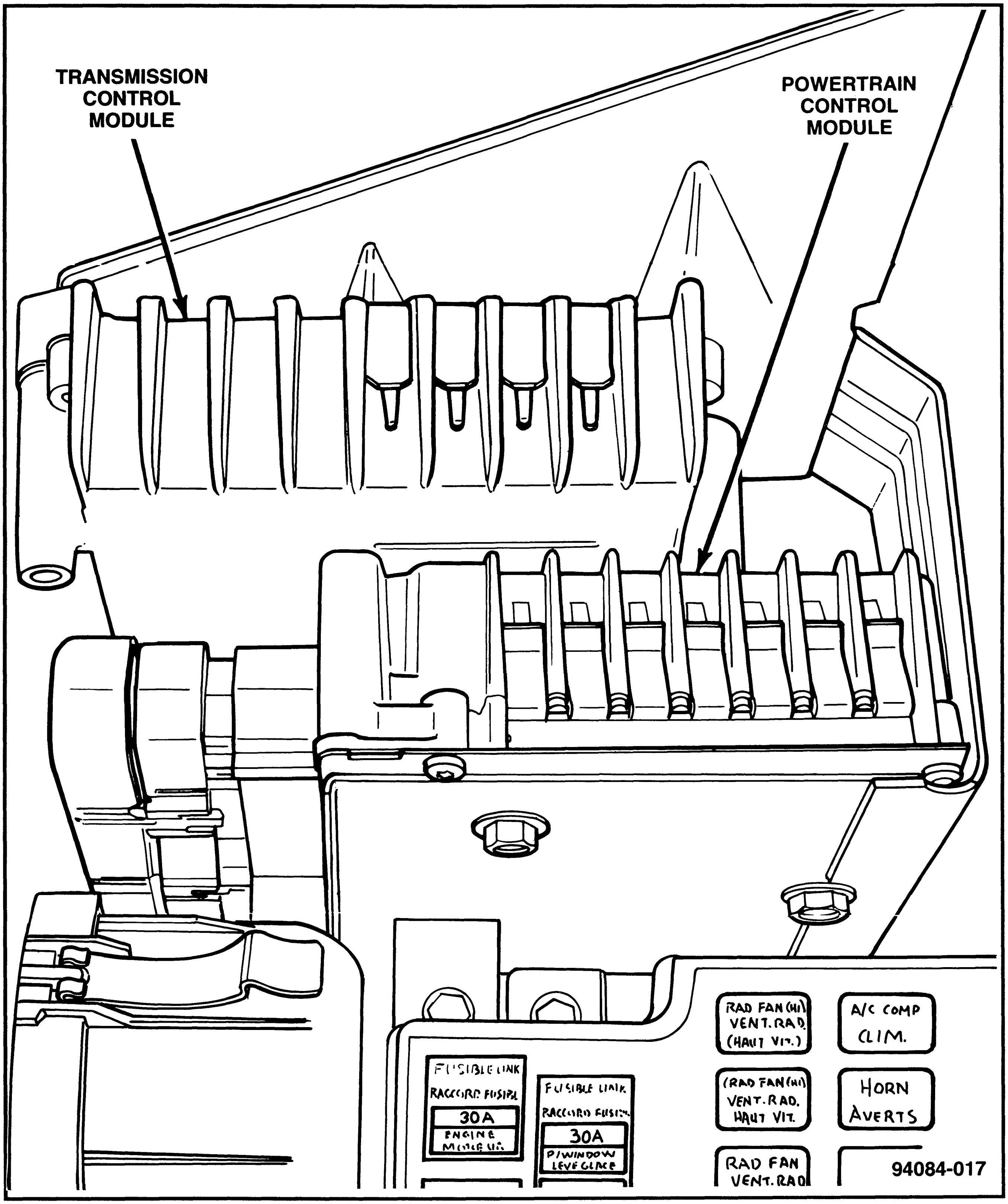


Figure 16 Powertrain Control Module (PCM)

PCM INPUTS

Crankshaft Position Sensor (CKP)

The Talon uses a Hall-effect Crankshaft Position sensor as a PCM input. Previous four-cylinder models used, a distributor-mounted pickup for this task. The Crankshaft Position sensor is mounted on the engine block, just above the oil filter (fig. 17), where it interfaces with the second crankshaft counterweight, which is machined with two sets of four timing notches.

The PCM uses the Crankshaft Position sensor to calculate the following:

- Engine rpm
- TDC number 1 and 4
- Ignition coil synchronization
- Injector synchronization
- Camshaft-to-crankshaft misalignment (Timing belt skipped 1 tooth or more diagnostic trouble code)

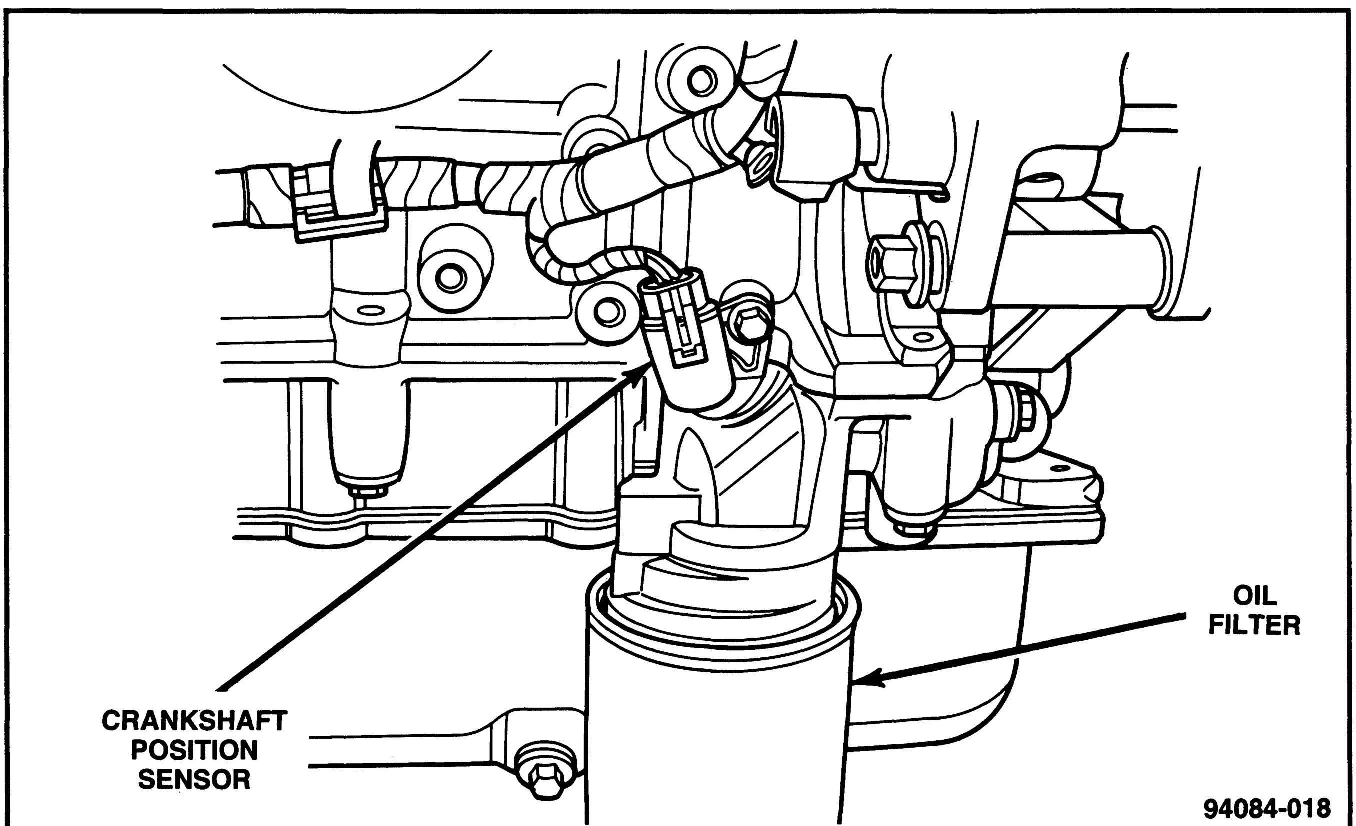
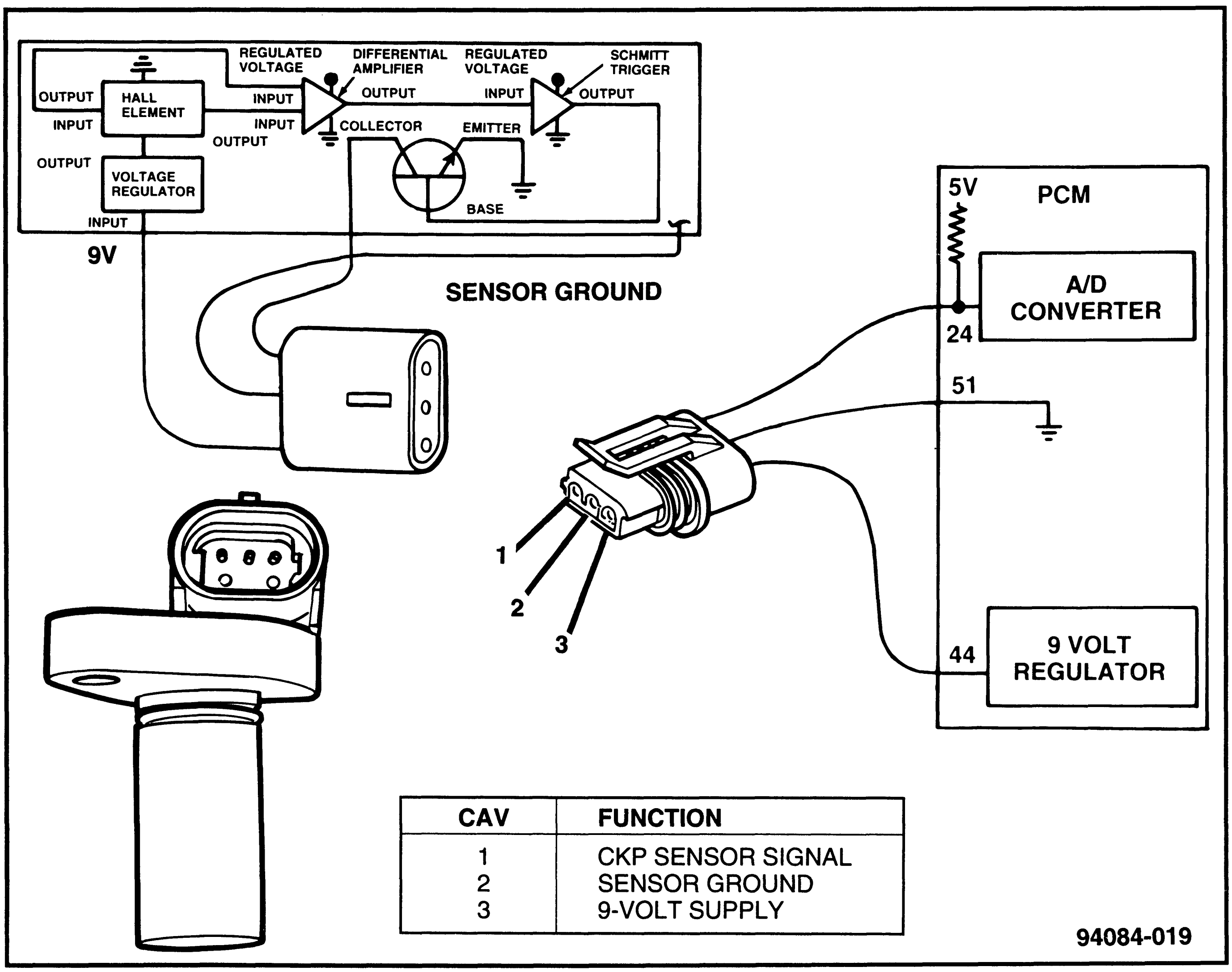


Figure 17 Crankshaft Position Sensor

The PCM sends 9 volts to the Hall-effect sensor from pin 44 of the 60-way connector. This voltage is required to operate the Hall-effect chip and the electronics inside the sensor (fig. 18). A ground for the sensor is provided through pin 51 of the PCM. The input that the PCM uses to detect the passage of the notches is from pin 25, through which a five-volt signal is sent from the PCM.

The Hall-effect sensor contains a powerful magnet. As the magnetic field passes over the dense portion of the counterweight, the 5-volt signal is pulled to ground through a transistor in the sensor (fig. 18). When the magnetic field passes over the notches in the crankshaft counterweight, the magnetic field turns off the transistor in the sensor, causing the PCM to register the 5-volt signal. The PCM identifies crankshaft position by registering the change from 5 to 0 volts, as signaled from the Crankshaft Position sensor.



CAV	FUNCTION
1	CKP SENSOR SIGNAL
2	SENSOR GROUND
3	9-VOLT SUPPLY

Figure 18 Crankshaft Position Sensor Circuit

The two sets of machined crankshaft counterweight notches are spaced 180° apart. The four timing notches in each set are placed 20° apart. One notch in each of the sets identifies TDC of piston number 1 or 4. The identifying notch spans an arc 60° wide (fig. 19).

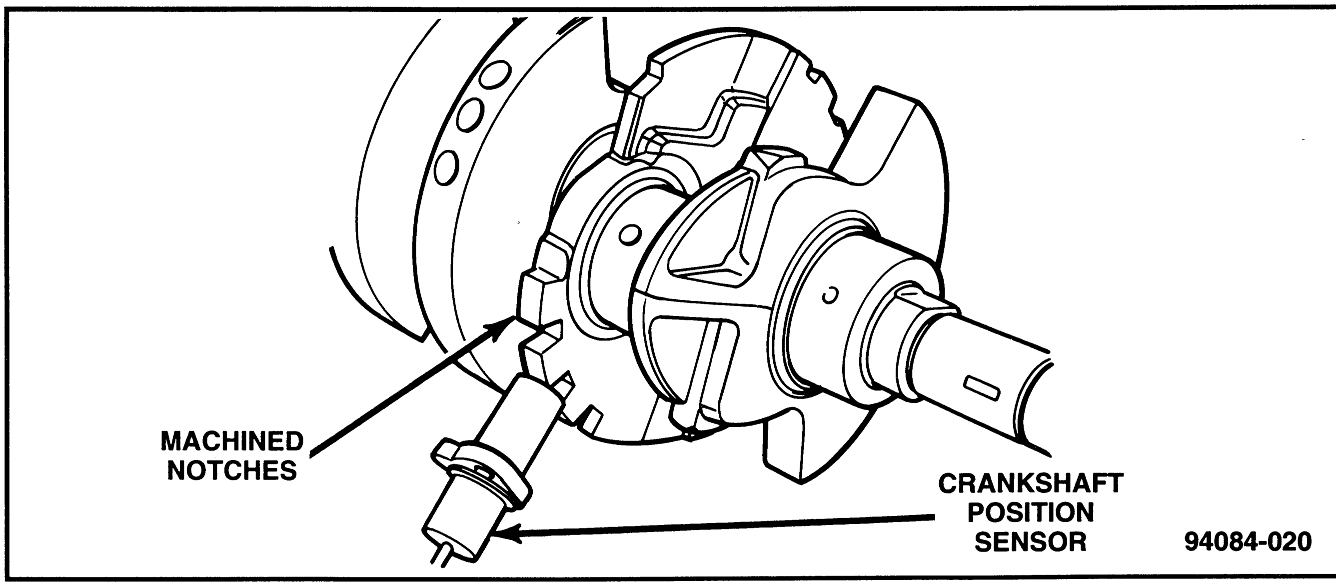


Figure 19 Crankshaft Counterweight

To represent what is registered by the PCM on pin 25, figure 20 identifies the notches in the crankshaft, and the crankshaft angles at which the notches appear.

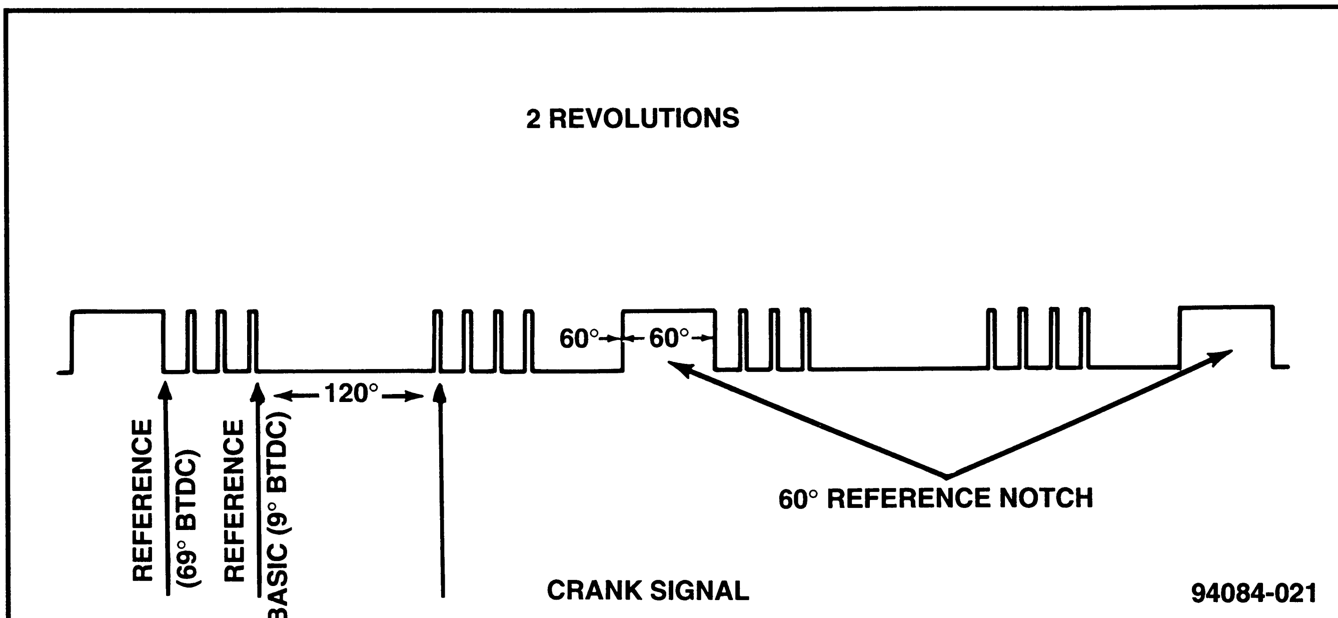


Figure 20 Sensor Signal

Sensor output voltage pulse-width is dependent upon crank rotational speed. The faster the crank turns, the shorter the time between the individual high/low pulses produced by the sensor (fig. 21). It is these changes of direction, or edges, that the PCM uses to make its calculations. The PCM registers the time elapsed between the 60° notch and the following 9° notch. In this way the sensor is able to relay crankshaft speed and position to the PCM, and also identifies whether or not the crankshaft is accelerating or decelerating. The PCM uses this information to aid in diagnosing of an engine misfire.

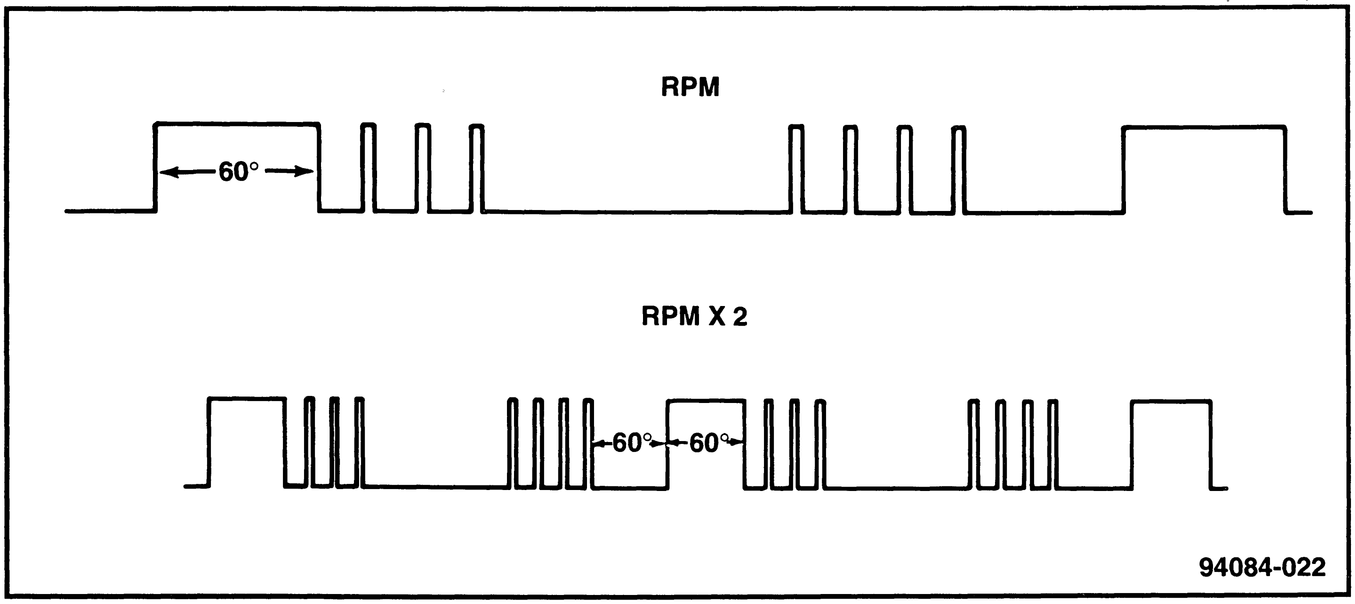


Figure 21 Sensor Data Pulse Width Changes

The PCM compares the signals sent by the Camshaft Position sensor to the signals sent by the Crankshaft Position sensor to calculate whether or not the camshaft is in time with the crankshaft (Timing belt skipped 1 tooth or more DTC). The operation of this function is explained on page 30.

The Crankshaft Position sensor is one of the most important inputs the PCM needs for its calculations. Without input from the Crankshaft Position sensor, the PCM will not allow the engine to operate.

Crankshaft Position Sensor Service

The sensor's powerful magnet is susceptible to damage. Do not drop the sensor on a metal table or store sensors face-to-face. The clearance between the sensor and the counterweight is non-adjustable. Though the clearance is critical, manufacturing tolerances allow for some differences in clearance.

Camshaft Position Sensor (CMP)

The Camshaft Position sensor is mounted to the rear of the cylinder head (fig. 22), and is driven by the exhaust camshaft, for which the sensor serves the dual purpose of controlling camshaft endplay and sending cam position information to the PCM.

Camshaft position information on earlier models determined by a Hall-effect sensor located in the vehicle's distributor (sync pickup). The new positioning of the sensor, against the camshaft, allows the PCM to receive a more accurate reading of camshaft position.

The PCM uses the Camshaft Position sensor to calculate the following:

- Injector synchronization
- Camshaft-to-crankshaft misalignment (Timing belt skipped 1 tooth or more DTC)

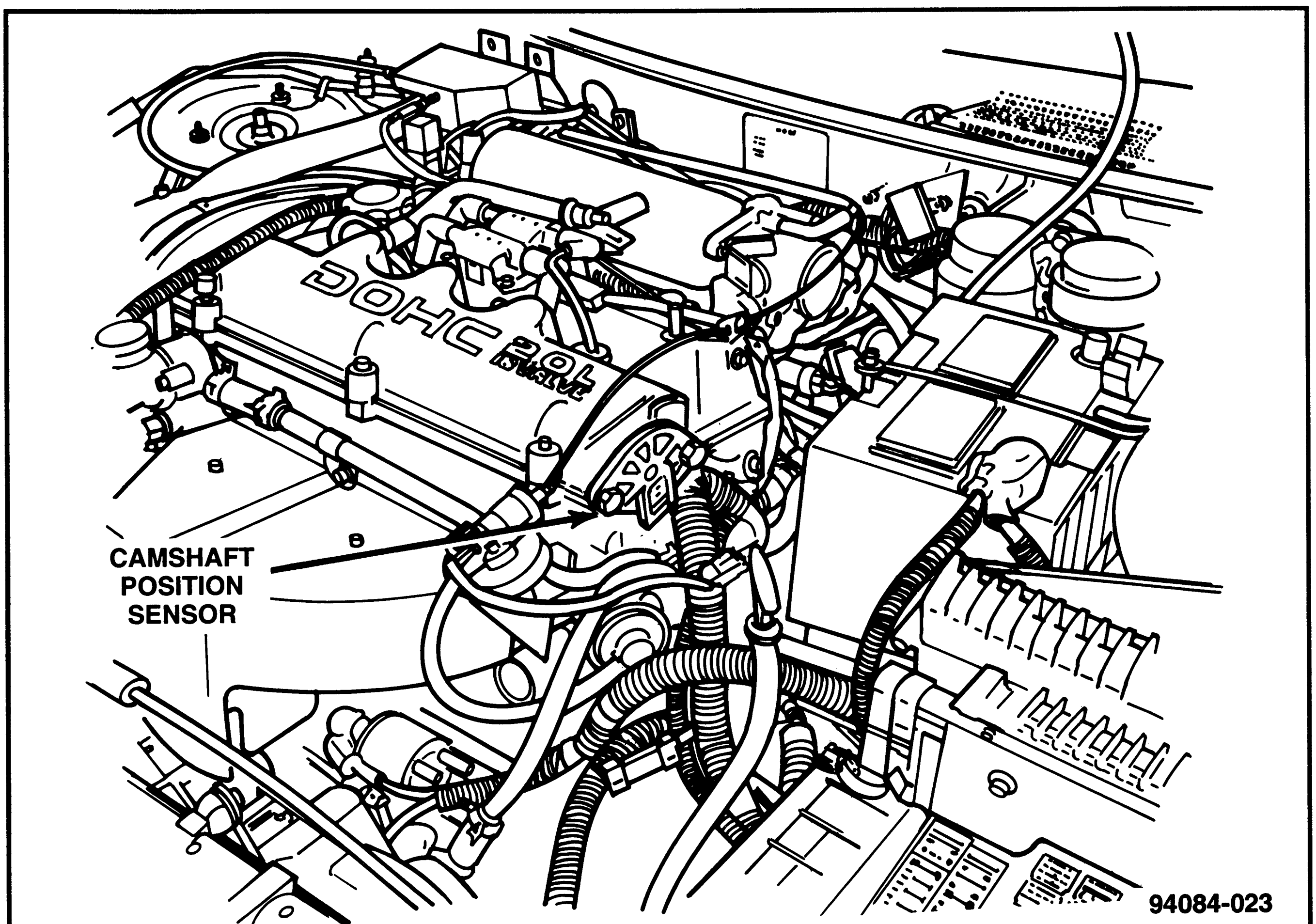
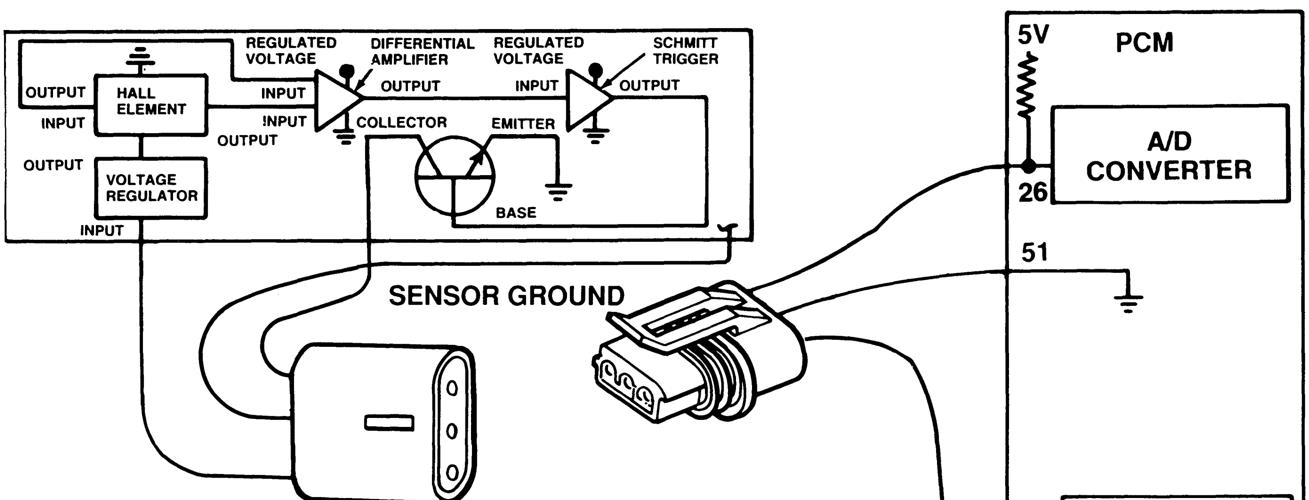


Figure 22 Camshaft Position Sensor

Similar to the Hall-effect used on the Crankshaft Position sensor, 9-volts is supplied from the PCM to the sensor through pin 44, and the sensor's ground is supplied through pin 51 of the PCM. The sensor's signal is registered by the PCM through pin 26. The Camshaft Position Sensor (like the CKP sensor) switches between 0 and 5 volts as the magnetic field changes (fig. 23).



CAV	FUNCTION
1	CMP SENSOR SIGNAL
2	SENSOR GROUND
3	9-VOLT SUPPLY

94084-024

Figure 23 Camshaft Position Sensor Circuit

The major difference between the Crankshaft and the Camshaft Position sensors is that the CMP sensor has no magnet. Instead, a target magnet is attached to the end of the camshaft (fig. 24). The magnet has four pole pieces, two north pole pieces and two south pole pieces. As the camshaft rotates, the north pole of the target magnet passes under the sensor, causing the transistor in the sensor to turn off, which allows the PCM to register 5 volts. The transistor turns back on when the south pole of the magnet passes under the sensor, causing the 5-volt signal to be pulled to a ground.

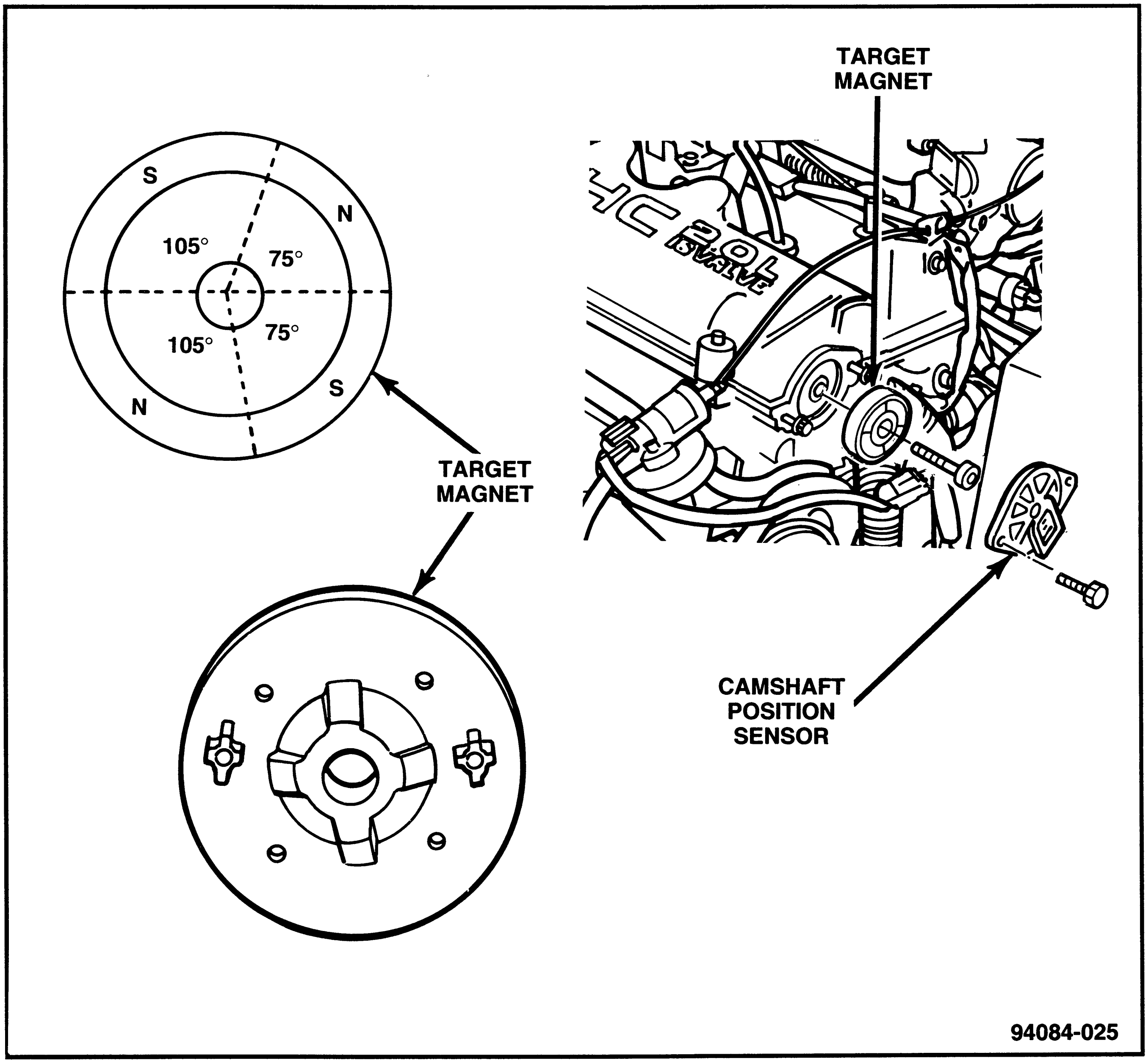


Figure 24 Camshaft Position Sensor with Target Magnet

The target magnet's polarity is unevenly spaced. One north pole piece is attached so that as the camshaft rotates, the signal recorded by the PCM lasts a total of 75° of camshaft rotation, while the other north pole magnet's signal lasts a total of 105°. The south pole piece is spaced in the same manner, 75° and 105° (fig. 24). The uneven distribution of polarity on the target magnet allows the PCM to determine cam position based upon these signals.

The target magnet is attached to the camshaft with one Allen screw. The magnet is indexed by two locating pins that are offset (fig. 24) to insure proper positioning of the target magnet. In one revolution of the camshaft, the PCM recognizes four signals spaced as shown in figure 25. The crankshaft rotates twice that of the camshaft. When comparing the angles of rotation of the crankshaft, the angles of the camshaft double.

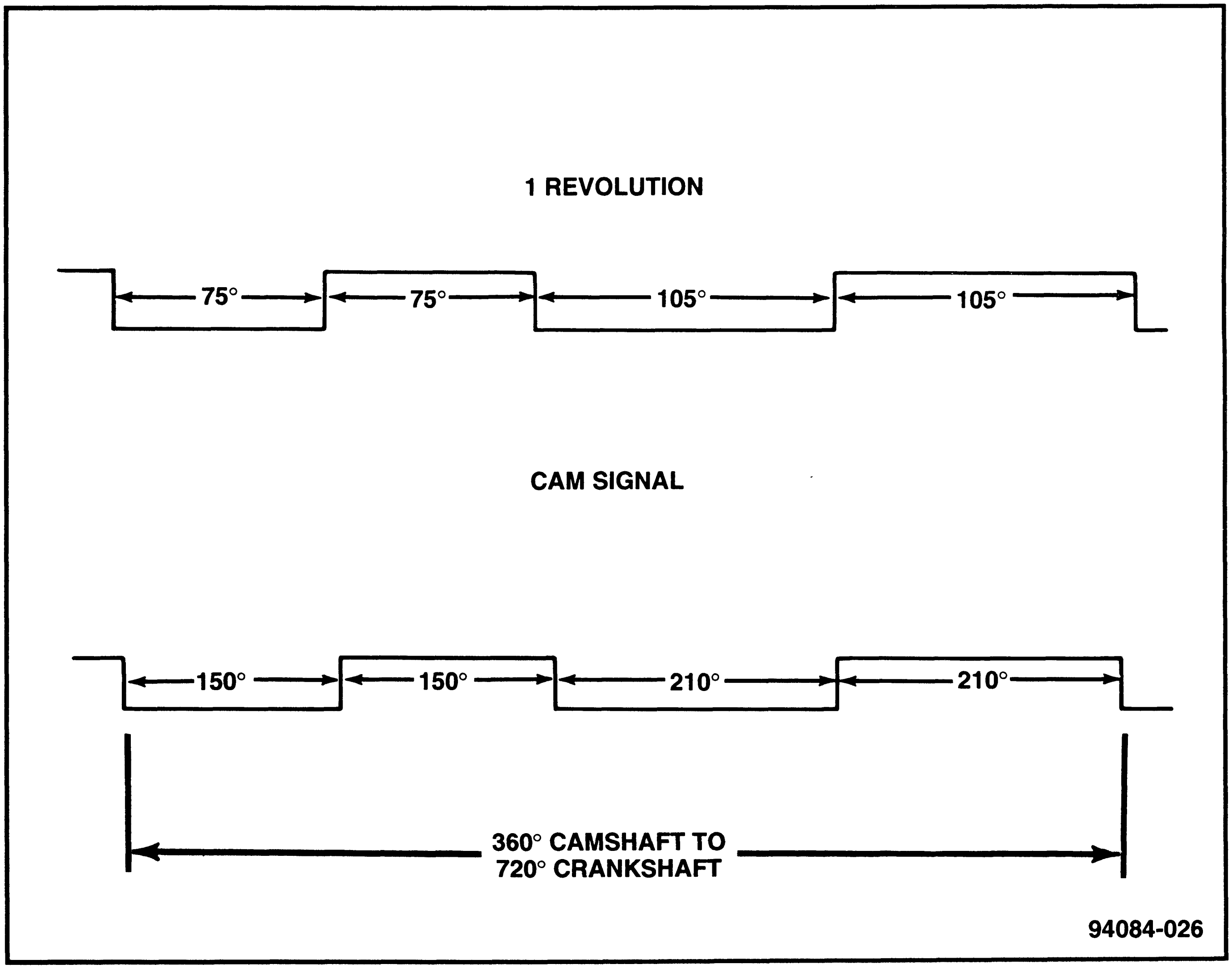


Figure 25 Camshaft Position Sensor Signal

By combining information from both the CMP sensor and the CKP sensor, the PCM can accurately determine fuel injection timing (fig. 26) and monitor for timing belt slip.

The PCM can synchronize the CMP and CKP sensors within one revolution of the crankshaft. As the crankshaft rotates, the CKP sensor switches from 0 to 5 volts as the notches pass the sensor. When the PCM recognizes the 60° notch, it determines that either piston 1 or piston 4 is approaching TDC. The PCM can determine which piston it is by the Camshaft Position sensor. If, when the CKP sensor indicates 5 volts because it is in front of the 60° notch and the camshaft position sensor indicated a switch from 5 to 0 volts, the PCM knows that piston 1 is approaching TDC. If the CMP sensor switches from 5 to 0 volts before the CKP sensor indicates the 60° notch, then the PCM knows that piston 4 is approaching TDC (fig. 26).

The following is the sequence of operation at start up:

1. At key-on, the fuel pump relay is energized for approximately 1 to 5 seconds to provide power to operate the fuel pump. This is done to charge the fuel lines and fuel rail with enough fuel pressure to start the engine quickly.
2. As soon as the CKP sensor indicates the engine is being cranked, the ASD relay is energized providing power to the ignition coil pack and the injectors. The fuel pump relay is also energized. During the first signal generated by the CKP sensor, the PCM pulses all four injectors simultaneously. (This system does not pulse the injectors at key-on for a primer feature.)
3. During the next two groups of signals from the CKP sensor, the PCM attempts to synchronize the CKP and CMP sensors. During this time, no injectors are pulsed, but the ignition coil is fired in the appropriate order.
4. After synchronization, the PCM pulses the injectors sequentially in the ignition firing order.
5. When the engine speed exceeds 400 rpm, the PCM switches from a cranking mode to a running mode.

If the CMP sensor does not function during cranking, the PCM will attempt to synchronize injector firing. When this occurs, engine cranking time increases dramatically. The PCM "guesses" where TDC number 1 is by locating the 60° notch. Since this notch appears for both pistons 1 and 4, there is a 50/50 chance that the injectors are fired in the improper order. Since there is a chance that the engine may start out of synchronization, the MIL is illuminated and a DTC is stored in the PCM's memory.

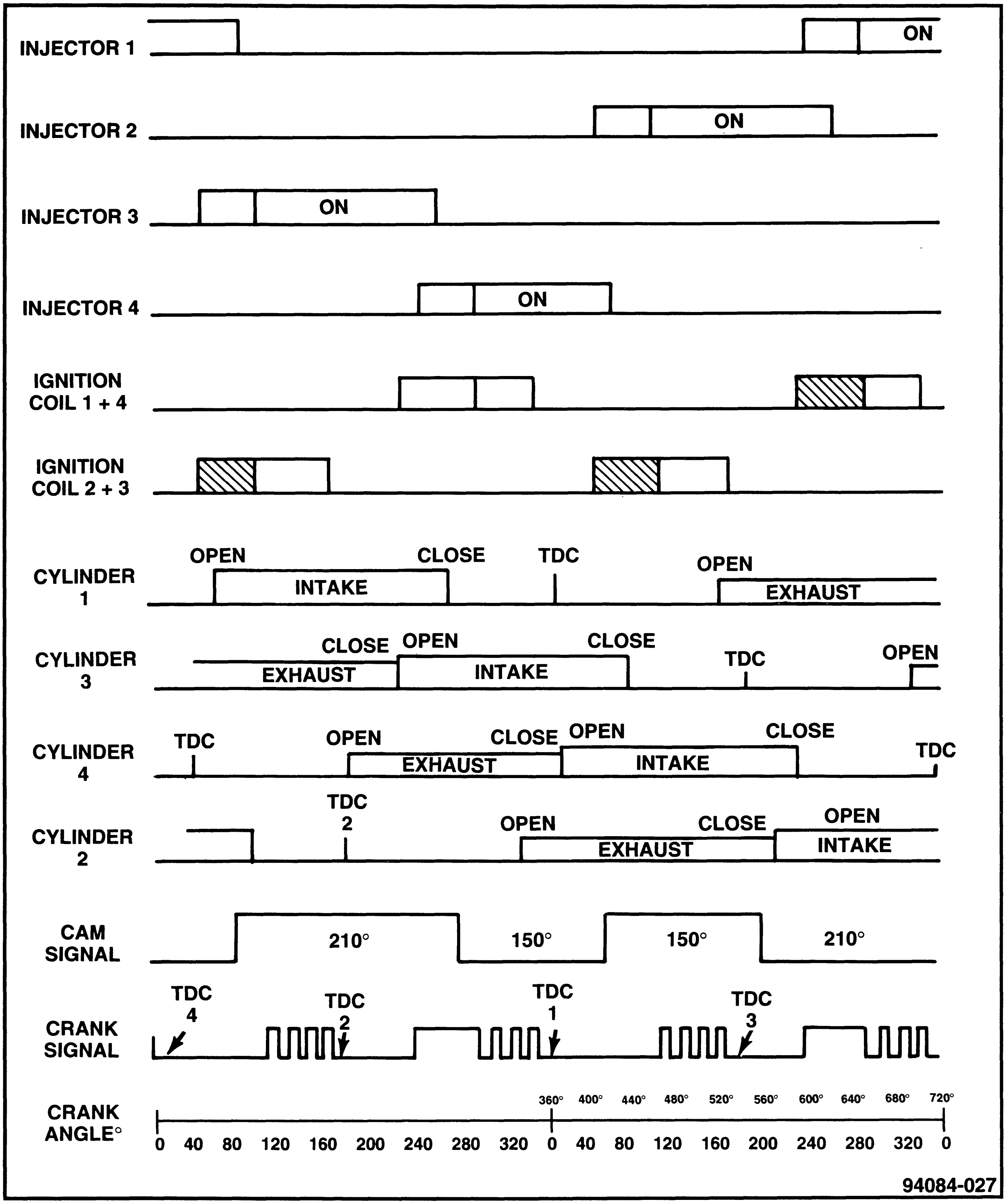


Figure 26 Ignition and Injection Sequence Chart

Cam/Crank Service

When the engine is cranked for the first time at the assembly plant, the PCM stores the angle between the Crankshaft Position sensor and the Camshaft Position sensor in a designated Electronically Erasable Programmable Read Only Memory (EEPROM). This angle can be read by the technician using the DRB III scan tool in a screen labeled "Cam Timing Position." The screen gives information on the angle differences between the camshaft and the crankshaft. 0° means that there is no difference between the recorded angle stored in the EEPROM and the angle determined by comparing the Camshaft Position sensor with the Crankshaft Position sensor. A Diagnostic Trouble Code is stored in memory when the angle difference exceeds 13°. If the timing belt skips one tooth, the angle will exceed 17°. The 2.0L DOHC engine is **not** a broken timing belt valve clearance engine, which means that if the belt skips more than three teeth, the valves will hit the top of the pistons.

The purpose of the DTC is to warn technicians when the belt is loosening, or has skipped one tooth or more. Under most circumstances, this means that it is time to service the timing belt or its related components. Refer to the Diagnostic Test Procedure Manual when performing any service related to the Talon's fuel, ignition or emissions systems.

Chrysler has built-in tolerances during manufacturing of the 2.0L DOHC engine and its components. Certain components, when replaced, may change the angle between the CMP and CKP sensor readings, yet no problems will exist. The following list of components, when replaced, require the use of the DRB III scan tool to reset "Cam/Crank" angles.

- Camshaft
- Cylinder head
- Cylinder block
- CMP sensor
- CMP sensor's target magnet
- Water pump

Any time the PCM is replaced, the new PCM learns the cam/crank angle.

Caution: *If the timing belt has been installed incorrectly, and the PCM has had its EEPROM erased, the PCM learns an incorrect angle and cannot identify the camshaft being out of synchronization with the crankshaft.*

Manifold Absolute Pressure (MAP) Sensor

The Talon's MAP sensor is located on the engine's intake manifold (fig. 27). In previous four-cylinder engines, the MAP sensor was located on the bulkhead. Moving the sensor to the manifold eliminates the need for a hose connecting the MAP to the engine, and reduces the possibility of moisture contamination.

The PCM uses the MAP sensor to aid in calculating the following:

- Barometric pressure
- Engine load
- Manifold pressure
- Injector pulse-width
- Spark-advance programs
- Shift-point strategies (F4AC1 transmissions only, via the CCD bus)
- Idle speed

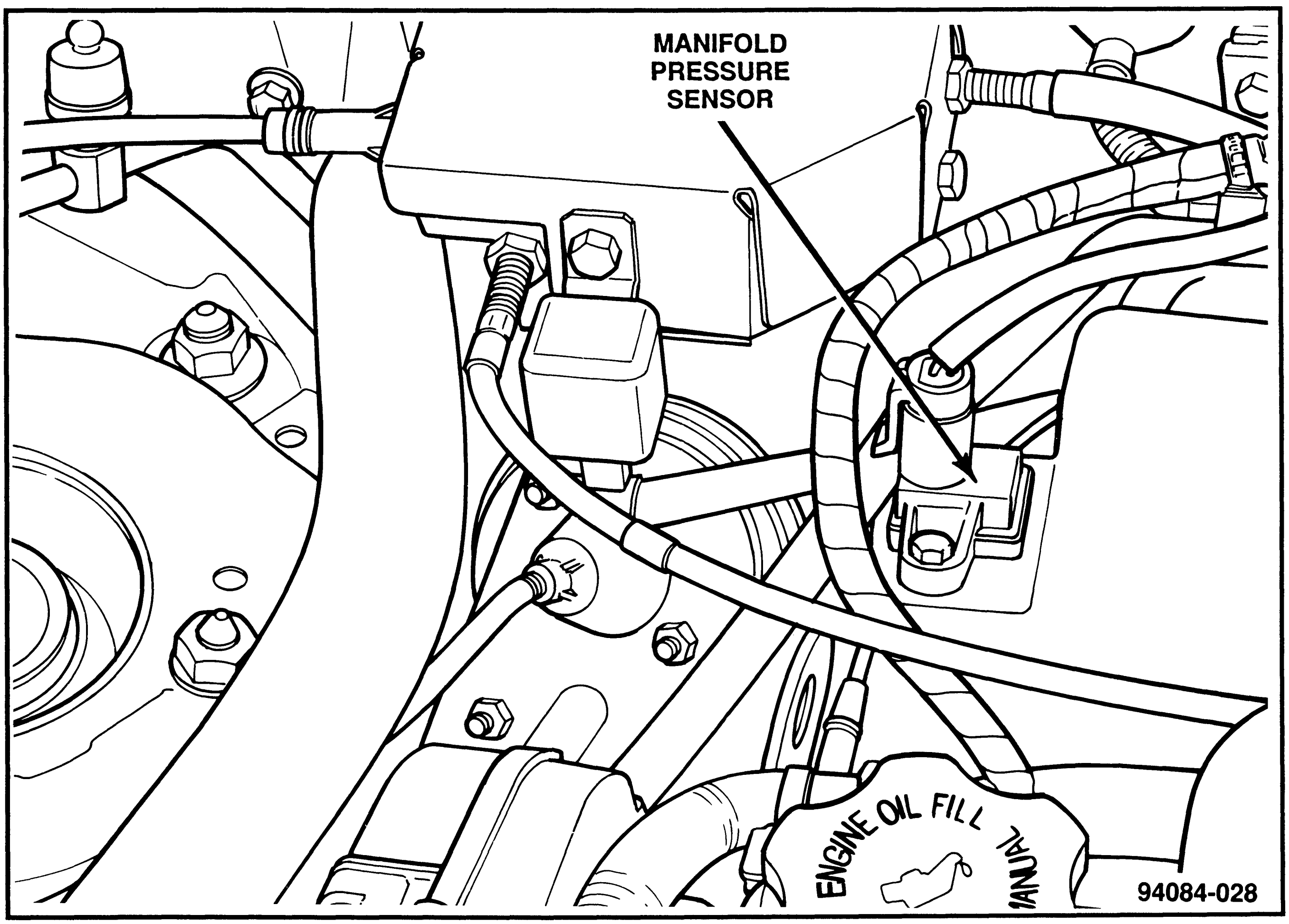


Figure 27 Manifold Pressure Sensor

Through pin 43 of the 60-way connector, the PCM sends the MAP a regulated signal of approximately 4.8 to 5.1 volts to operate the MAP sensor's electronics (fig. 28). Pin 51 serves as a grounding location for the MAP and pin 29 is the PCM's MAP sensor input.

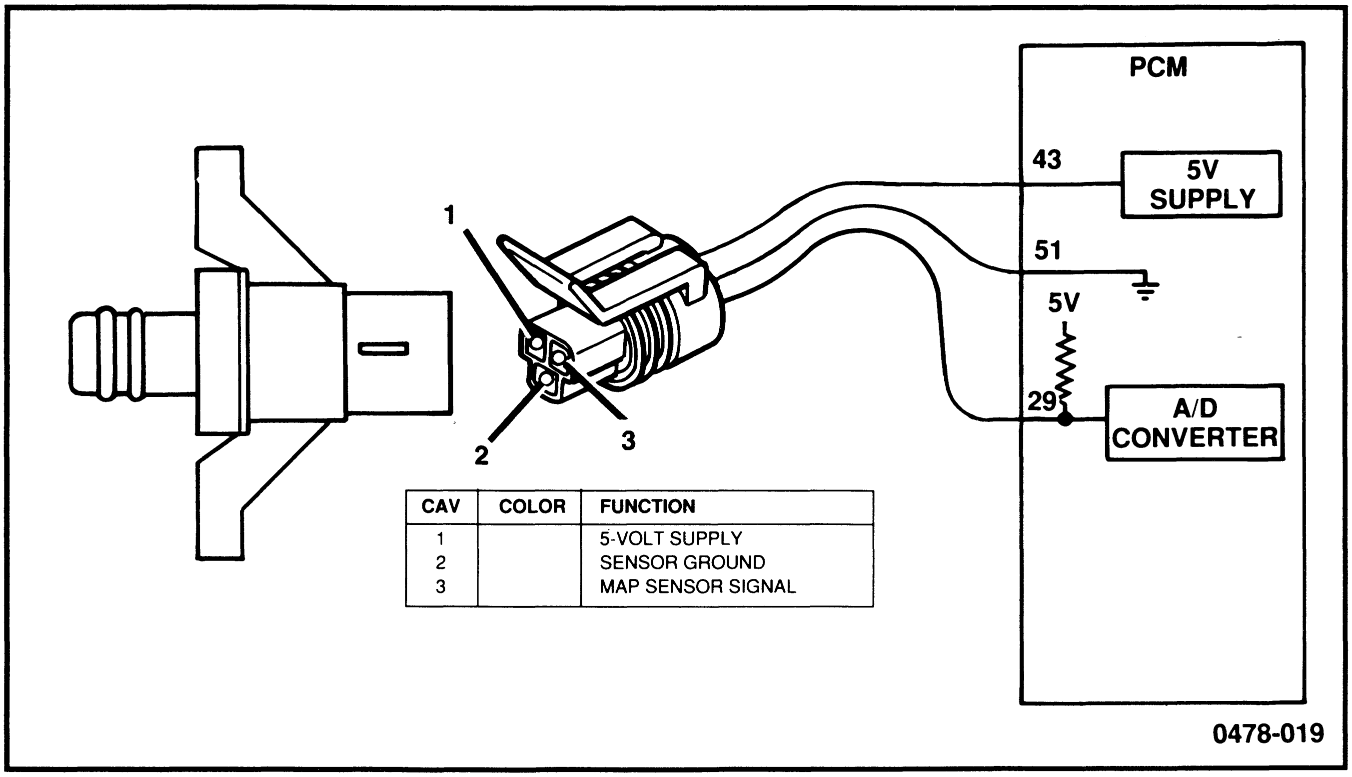
The Talon's MAP sensor is mounted on the intake manifold (as in other Chrysler products). The MAP sensor uses a ceramic disc to convert pressure into a capacitive discharge. The discharge controls the amount of voltage drop delivered by the sensor to the PCM. Previous MAP sensors used by Chrysler positioned a "Wheatstone bridge" between a sealed chamber with an internal pressure of 29.92 in. Hg, and with the pressure port going to the manifold. As pressure changed in the manifold, the strain on the Wheatstone bridge would change the resistance of the circuit. The output from the Talon's MAP sensor is transparent to the PCM compared to previous sensors.

During initial key-on the sensor reads barometric pressure. The value is based upon conditions such as altitude and atmospheric conditions. A normal range can be obtained by monitoring known good sensors in your working area. At Wide Open Throttle (WOT) conditions, the PCM updates the MAP memory cell. With periodic updates, the PCM can make its calculations more effectively. The reason the PCM needs to know barometric pressure is to determine the density of air entering the intake manifold.

The PCM recognizes a decrease in manifold pressure by monitoring a decrease in voltage from the reading stored in the barometric pressure memory cell. The MAP sensor is a linear sensor; as pressure changes, voltage changes proportionately. The range of voltage output from the sensor is usually between 4.6 volts at sea level to as low as 0.3 volts at 26 in. of Hg (Table 1). Always use the Diagnostic Test Procedures Manual for MAP sensor testing.

MAP Sensor Limp-in

The PCM stores a DTC when the MAP sensor malfunctions. When the PCM sets a DTC, the MAP sensor's information is considered inaccurate. At this point, the PCM moves into "limp-in" mode. Limp-in for the MAP sensor allows the engine to continue to function, without input to the PCM from the MAP. The PCM must calculate the amount of air being consumed by the engine, which is accomplished by calculating MAP values based upon readings from the CKP sensor and the Throttle Position Sensor (TPS). Any time the PCM sets a DTC for MAP, the Malfunction Indicator Light (MIL) is illuminated. When the MAP sensor is in limp-in, the PCM limits the engine speed to 3616 rpm. If the MAP sensor sends realistic signals once again, the PCM moves out of limp-in, and resumes using the MAP values.



CAV	COLOR	FUNCTION
1		5-VOLT SUPPLY
2		SENSOR GROUND
3		MAP SENSOR SIGNAL

Figure 28 Manifold Pressure Sensor Circuit

MAP Sensor Service

There are two fluorosilicone O-rings on the MAP nipple that are susceptible to damage from shipping or careless installation. Be careful when removing or installing the MAP sensor.

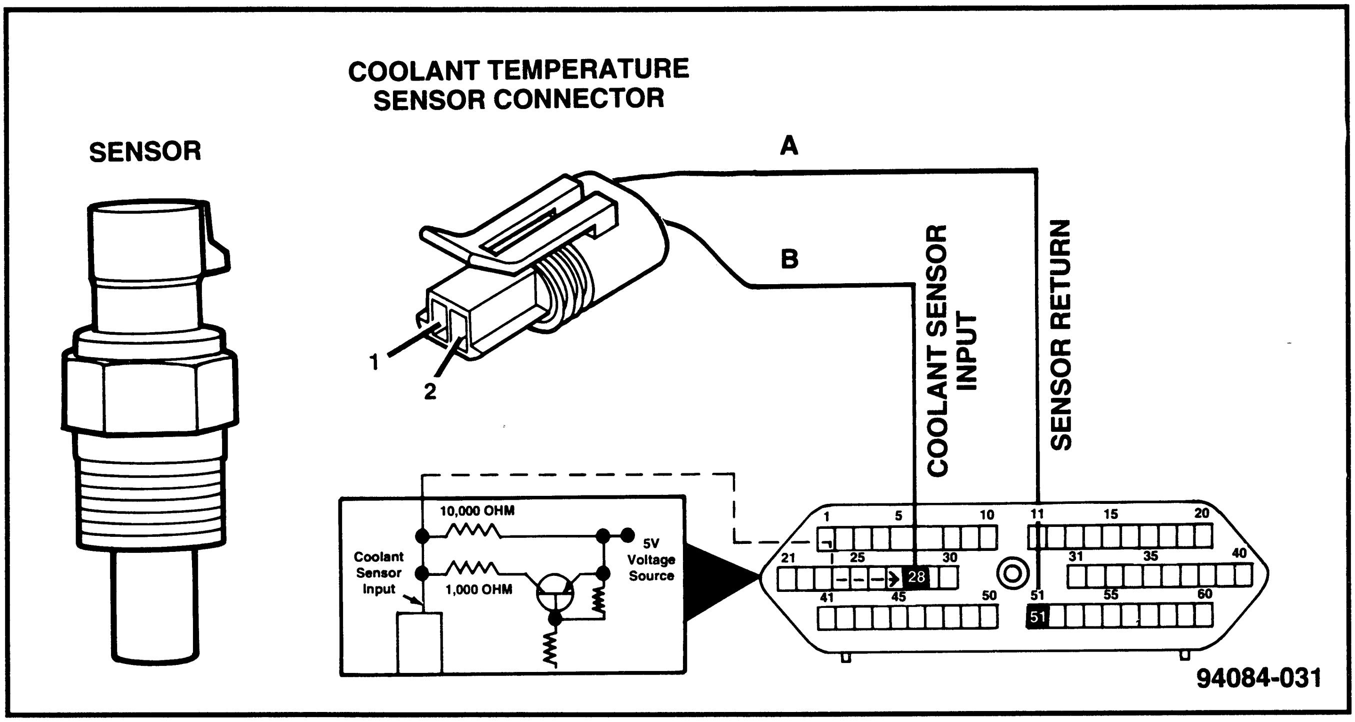


Figure 29 Engine Coolant Temperature Sensor Circuit

Table 2. Engine Coolant Temperature Sensor/Intake Air Temperature Sensor Voltage vs. Temperature Values (Cold and Hot)

DEGREES F	VOLTS		DEGREES F	VOLTS
-20	4.70 V		110	4.20 V
-10	4.57 V		120	4.00 V
0	4.45 V		130	3.77 V
10	4.30 V		140	3.60 V
20	4.10 V		150	3.40 V
30	3.90 V		160	3.20 V
40	3.60 V		170	3.02 V
50	3.30 V		180	2.80 V
60	3.00 V		190	2.60 V
70	2.75 V		200	2.40 V
80	2.44 V		210	2.20 V
90	2.15 V		220	2.00 V
100	1.83 V		230	1.80 V
110	1.57 V		240	1.62 V
120	1.25 V		250	1.45 V

ECT Sensor Limp-in

When the ECT sensor indicates a voltage that is too high or too low, the PCM sets a DTC. When the DTC is set, the MIL is illuminated and the PCM moves into limp-in mode. Limp-in for the ECT sensor is 104°F.

Intake Air Temperature Sensor (IAT)

The IAT sensor is threaded into the intake manifold, on the back side of the manifold. The IAT sensor sends information to the PCM on the density of the air entering the manifold, based upon temperature. The PCM uses this input to calculate the following:

- Injector pulse-width
- Adjustment of spark timing (to prevent knock with high-charge temperatures)

The IAT sensor has the most authority at cold temperatures and during Wide Open Throttle. At a temperature of -20°F and Wide Open Throttle, the PCM can increase fuel injector pulse-width by as much as 37%, based upon input from the IAT sensor.

The PCM receives input from the IAT sensor through pin 6, and supplies a ground for the IAT sensor through pin 51 of the PCM's 60-way connector (fig. 30). The resistance of the IAT sensor is the same as for the ECT sensor. The differences between the IAT sensor and the ECT sensor are as follows:

- Connectors are indexed differently
- IAT sensor thread diameter is smaller
- IAT sensor material is exposed through a plastic cage (to quicken response time)

The IAT sensor and its circuit function exactly the same as the ECT sensor and its circuit. For operation principles and voltage vs temperature reference chart, refer to the ECT Sensor Section.

IAT Sensor Limp-in

When the IAT sensor indicates a voltage that is too high or too low, the PCM sets a DTC. When the DTC is set, the MIL is illuminated and the PCM moves into limp-in mode. The IAT sensor uses the ECT sensor's information, as long as the information is believed to be accurate. If the ECT is already in limp-in, the PCM uses a temperature that has very little effect on fuel and spark programming.

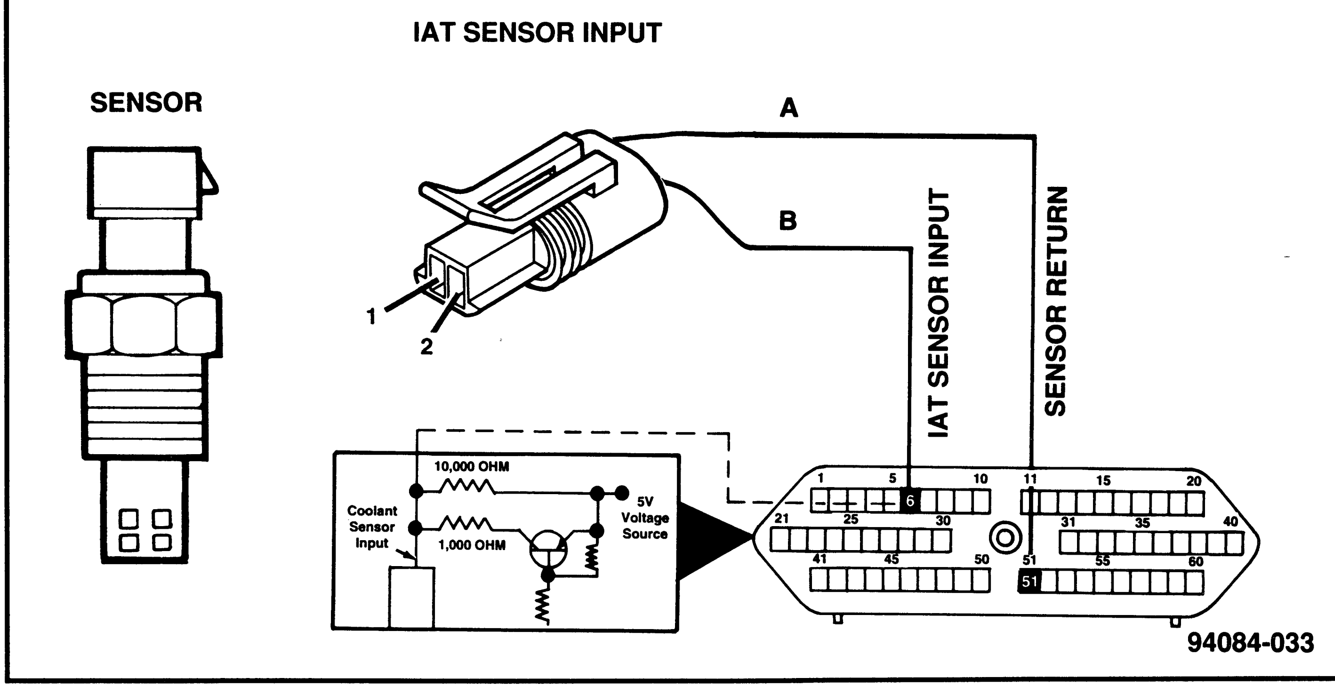


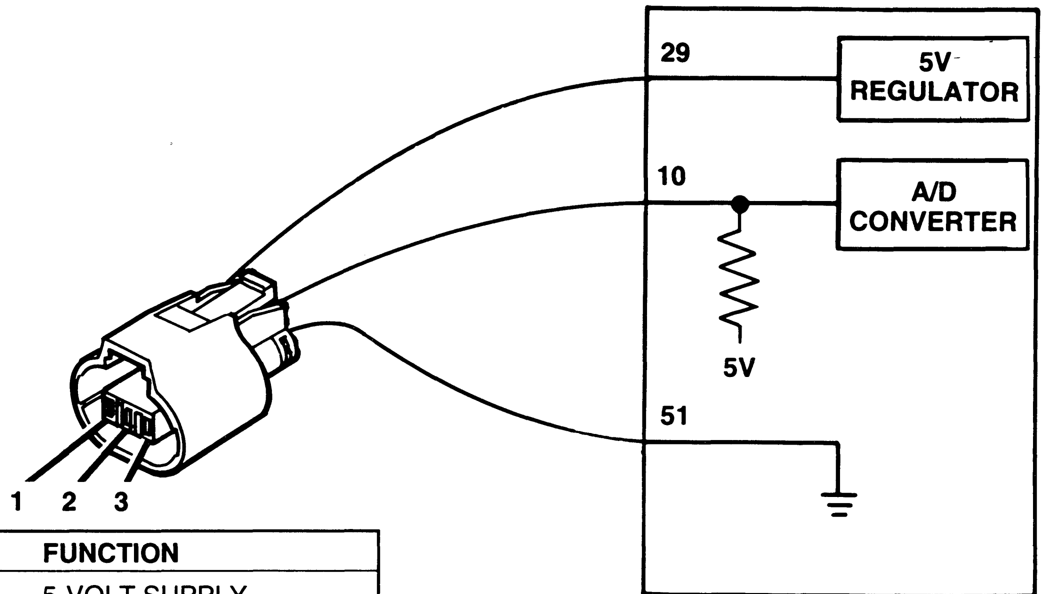
Figure 30 Intake Air Temperature Sensor Circuit

Throttle Position Sensor (TPS)

The throttle position sensor is mounted to the side of the throttle body (fig. 31). The PCM needs to identify the actions of the throttle blade at all times to assist in performing the following calculations:

- Ignition timing advance
- Fuel injection pulse-width
- Idle (learned value)
- Off-Idle (0.06 volt)
- Wide Open Throttle (WOT) open loop (2.608 volts above learned idle voltage)
- Deceleration fuel lean out
- Fuel Cutoff during cranking at WOT (2.608 volts above learned idle voltage)
- A/C WOT Cutoff

The TPS is supplied with a regulated voltage that ranges from 4.8 to 5.1 volts from PCM pin 43 of the 60-way connector. This output regulated voltage is the same regulated voltage that the MAP sensor uses. The TPS receives its ground from the PCM on pin 51, and the input of the TPS to the PCM is through pin 10 (fig. 31).



CAV	FUNCTION
1	5-VOLT SUPPLY
2	TP SENSOR SIGNAL
3	SENSOR GROUND

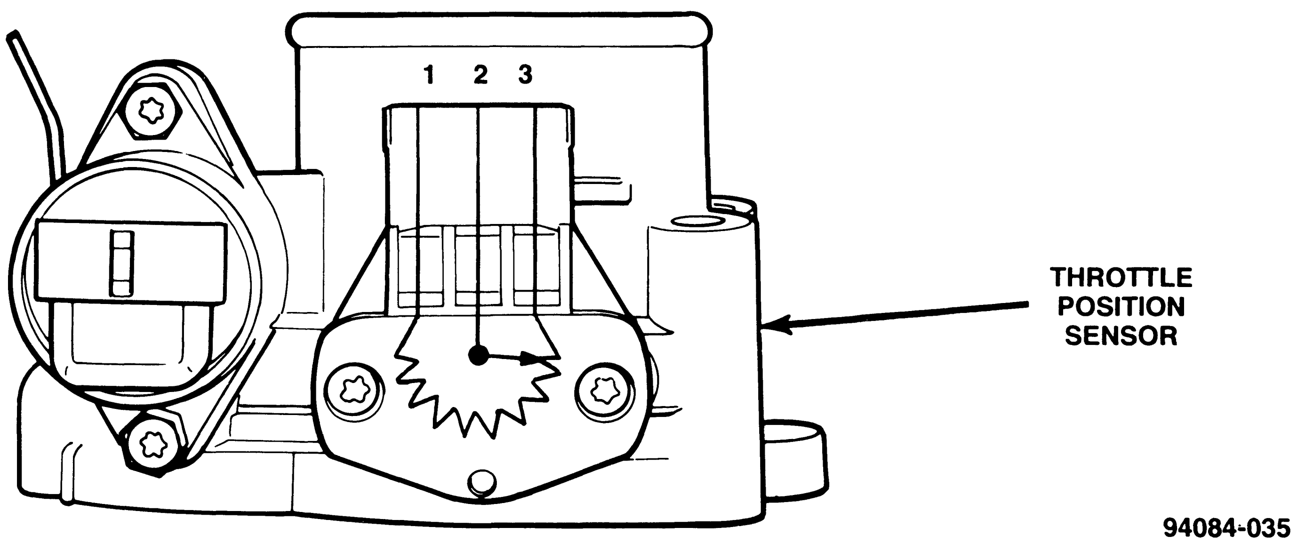


Figure 31 Throttle Position Sensor Circuit

TPS Programs

Idle

As with other Chrysler fuel-injection systems, the PCM is able to recognize an idle command based upon inputs from the TPS. Also, like other Chrysler systems, the PCM is programmed to monitor the TPS signal whenever the key is on. While the key is on, the PCM assumes that the lowest voltage it can receive on pin 10 must be where the throttle blade lever hits the idle stop. Normally this voltage range is approximately 0.5-1.0 volt. At the low voltage position, the PCM records the signal as "idle," better known as "minimum idle."

The PCM's memory is updated any time the voltage on pin 10 is less than the recorded value in the memory cell. Any time the PCM receives the idle voltage signal, the PCM is programmed to maintain idle, using timing and the Idle Air Control (IAC) motor. The following is a list of warm-idle rpm targets:

	Neutral MTX and ATX	Drive ATX Only
With the Power Steering switch indicating no load or A/C OFF	800 rpm	700 rpm
With the Power steering switch indicating a load or A/C ON	850 rpm	800 rpm

Spark advance curves and injection pulse-width programs are unique in that they are specifically calibrated for idle conditions. If the Talon is equipped with an automatic transmission, the PCM also has separate programs for idle neutral and idle drive. (Refer to the O^2 Sensor Section.)

Off-Idle

Once the throttle is opened, the PCM moves into its off-idle program at approximately 0.06 volts above minimum idle. As previously stated, spark advance curves and injection pulse-width programs are unique throughout the range of the TPS. The PCM performs another function, known as a "dashpot function." The dashpot function operates the IAC motor to prevent the possibility of the engine dying out during a sudden deceleration. One other function that aids in the prevention of engine die-outs is "minimum air flow."

Minimum Air Flow

Minimum air flow is the volume of air flowing past the throttle blades at idle and through any other components that might allow air to flow into the intake manifold at idle, such as the PCV valve.

Minimum air flow specifications aid in complete engine system diagnostics. Items such as poor driveability, worn engine components, engine components out of adjustment (timing belt), exhaust restrictions, and many other items can have an effect on minimum air flow. In short, a minimum air flow check can be done only after all fuel, ignition, emission, and engine mechanical components have been verified as "good." Other concerns include components that might put a load on the engine at idle, such as the radiator or condenser fans operating or the A/C compressor being engaged during the test.

When performing a minimum air flow check, all accessories should be off. The test is performed on the Talon with Tool 6457 and the DRB III scan tool. The tool is simply a 0.125 in. orifice, and the DRB III scan tool is used to access a program that causes the IAC motor to completely close off the idle air bypass port. The tool is installed in place of the PCV valve to allow the engine to maintain idle more smoothly. The minimum air flow specifications are as follows:

- Less than 1000 miles on the engine - 550-1200 rpm
- Over 1000 miles on the engine - 600-1200 rpm

Wide Open Throttle (WOT)

With the engine running, the PCM spark-advance and fuel pulse-width programs are affected during WOT conditions. The PCM enriches the air/fuel ratio at WOT to allow the combustion chamber to run a little cooler. To enrich the air/fuel ratio at WOT, the PCM is programmed to go into open loop any time the TPS voltage exceeds 2.608 volts above minimum idle. Also, at WOT the A/C compressor relay is de-energized to remove the A/C compressor load from the engine.

Deceleration

Under deceleration, the PCM is programmed to "lean out" the air/fuel ratio since engine power is not needed. One of the main components involved with the deceleration program is the TPS. If, while the vehicle is in motion (based on the Vehicle Speed Sensor), the TPS is closed, the PCM narrows the pulse width so that the air/fuel ratio becomes leaner. In some instances, the pulse width goes to 0.0 msec., at which time no fuel is supplied to the engine. This action causes extremely low vehicle emissions.

Wide Open Throttle Fuel Cutoff During Cranking

One last function that the PCM performs from inputs delivered by the TPS is the WOT fuel cutoff while cranking. To ensure short cranking times, the PCM fires all four injectors simultaneously, once, during cranking. After that, the PCM waits one revolution, then fires the injectors sequentially. If the programmed pulse-width allows too much fuel into the combustion chamber, or if circumstances do not allow the engine to start-up with the programmed quantity of fuel, the driver can operate the accelerator pedal to WOT so that the PCM de-energizes all injectors. This program occurs only during cranking and when the TPS voltage exceeds 2.608 volts above minimum TPS.

TPS Limp-in

When the TPS indicates a voltage that is too low, too high, or not believable, the PCM sets a DTC. When the DTC is set, the MIL is illuminated and the PCM moves into limp-in mode. Limp-in for the TPS is divided into three categories: Idle, Part-throttle, and WOT. These limp-in values are mainly rpm based, although the MAP sensor has an input to the program. While in limp-in, the PCM has a no-load rpm limiter of approximately 3616 rpm. Refer to the Diagnostic Test Procedures Manual for complete diagnostic information.

Power Supplies and Grounds

The PCM monitors battery voltage during engine operation. If the voltage level falls, the PCM increases the initial injector opening point to compensate for low voltage at the injector. Low voltage causes a decrease in current flow through the injector, and can prevent the injector plunger from fully opening in the allotted time, resulting in decreased fuel flow.

Battery charging rate is controlled also by the PCM. The target charging rate voltage is based upon inputs from a Battery Temperature Sensor (BTS) located on the PCM's circuit board.

The PCM must be able to store diagnostic information. This information is stored in a battery fed RAM. Once a DTC is read by the technician, the technician can clear the RAM by disconnecting the battery or using the DRB III scan tool.

The PCM uses pin 11 (fig. 32) to monitor the charging rate, control the injector initial opening point, and back-up the RAM used to store DTCs.

Ignition voltage is supplied to the PCM through pin 54. Battery voltage is supplied to pin 54 through the ignition switch when the ignition key is in the RUN or CRANK position. Voltage is supplied to this circuit to power the 9-volt regulator and to allow the PCM to perform fuel, ignition, and emissions control functions (fig. 36).

A power ground is supplied through pins 2 and 22, and a signal ground is supplied through pin 52. The power grounds are used to enable control of the ground side of any relay, solenoid, ignition coil, or injector. The signal ground is used for any input that uses pin 51 as a ground, and as the ground side of any internal processing component (fig. 32)

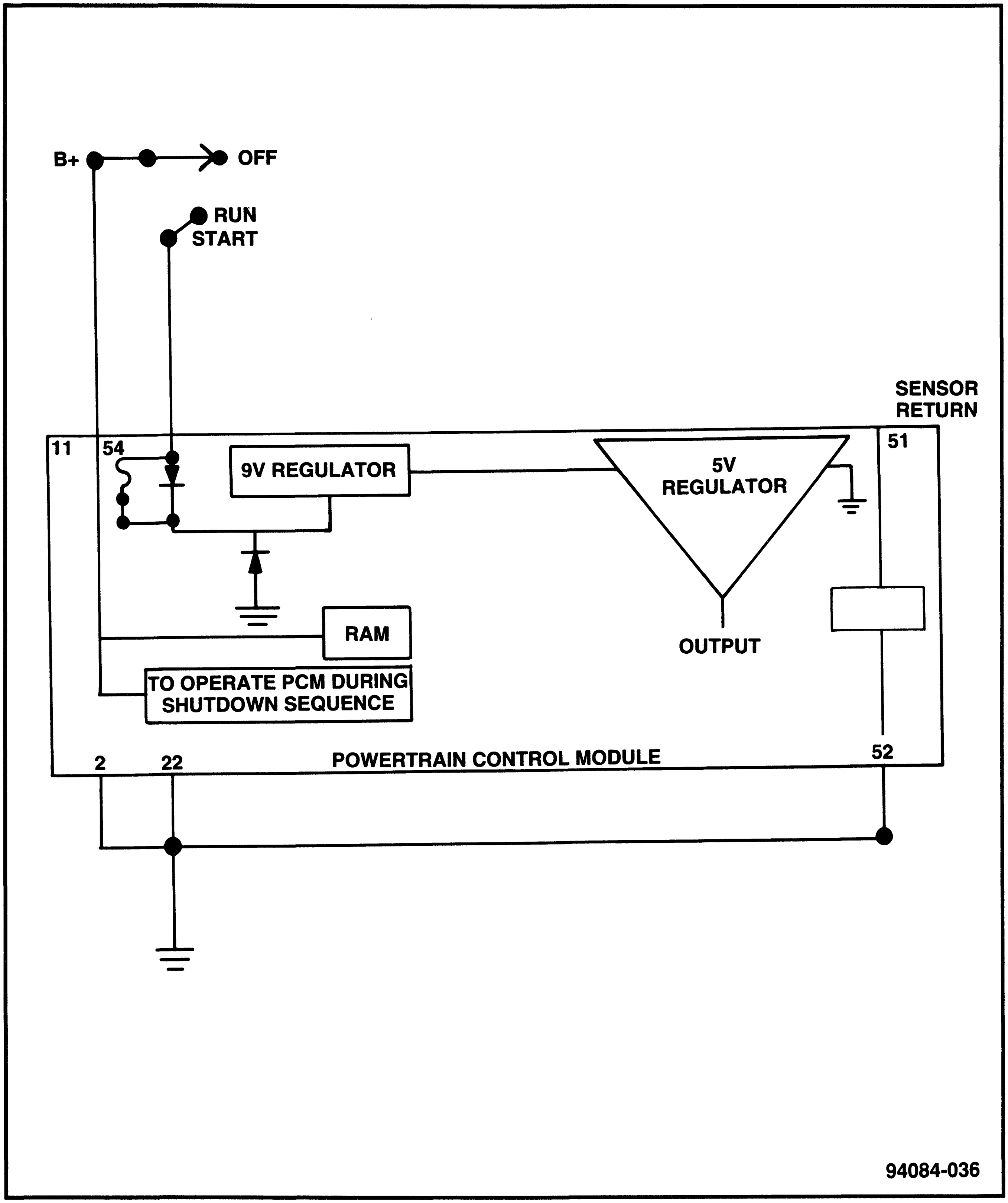
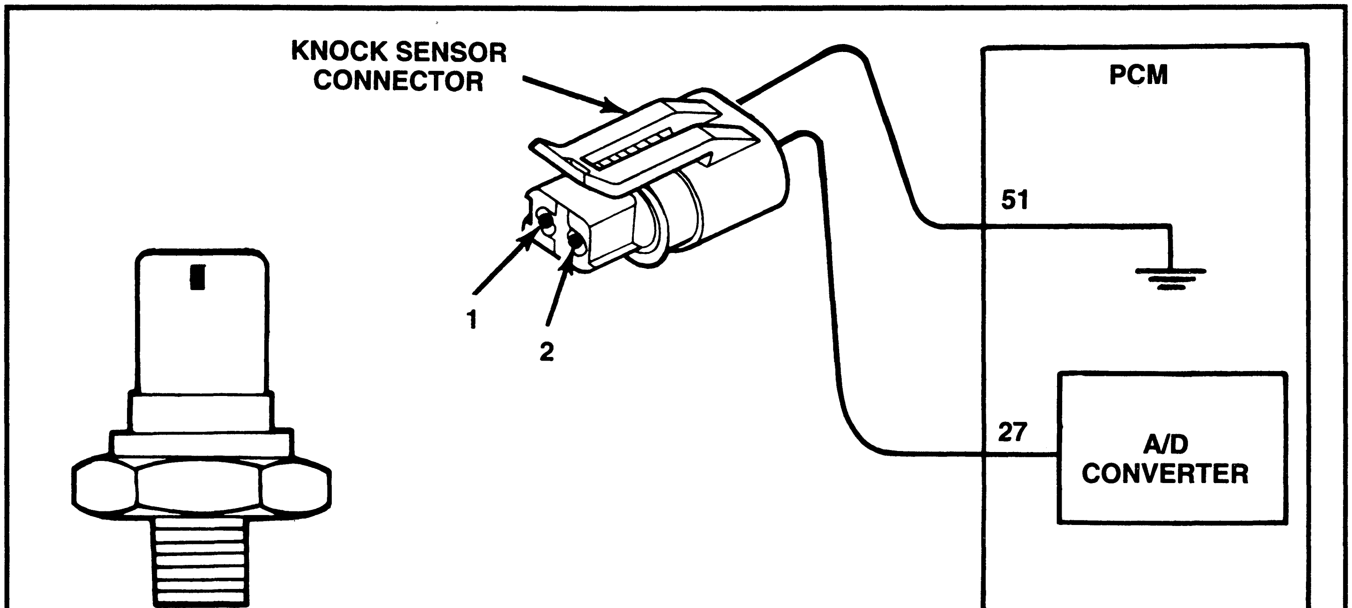


Figure 32 Power Supplies and Ground

Knock Sensor

The Knock Sensor is located near the Crankshaft Position sensor, on the side of the engine block. The sensor consists of a piezoelectric material that vibrates as the engine runs, sending an AC voltage signal to the PCM. The voltage signal produced increases with the frequency of vibration. When the signal reaches a preset threshold, the PCM retards ignition timing to reduce engine knock.

The Knock Sensor's output is delivered to the PCM through pin 27, and grounded through pin 51 of the PCM's 60-way connector (fig. 33).



CAV	FUNCTION
1	SENSOR GROUND
2	KNOCK SENSOR SIGNAL

94084-038

Figure 33 Knock Sensor Circuit

Knock Sensor Program

The Knock Sensor is designed to retard timing only under certain operating conditions. At idle, the PCM is programmed to disregard any Knock Sensor input. Once the engine speed exceeds a preset value (900 rpm on a manual transaxle vehicle or 1120 speed on a automatic transaxle vehicle), knock retard is allowed. Knock retard uses a short term and a long term memory program. Long term memory records previous detonation in a battery-backed RAM. The maximum authority that long term memory has over timing retard is 3°.

Short term memory is allowed to retard timing up to 3° under all operating conditions (as long as rpm is above the minimum rpm) except WOT. At WOT, the PCM can retard 4° using short term memory. The use of short term memory allows the PCM to retard timing quickly in the event of detonation, whereas long term memory builds and decays over time while the engine is running. Short term memory is lost any time the ignition key has been turned to OFF. Between short term memory and long term memory, the PCM has the authority to retard as much as 7° of timing.

Oxygen (O_2) Sensors

The Talon, if equipped with a manual transaxle, uses two heated oxygen sensors (fig. 34) to monitor the fuel system and catalyst operation. On a Talon with an automatic transaxle, only one upstream O_2 sensor is used. The upstream sensor is located on the exhaust manifold. It provides the PCM with a voltage signal (0-1 volt) inversely proportional to the amount of oxygen in the exhaust. The PCM uses this information to adjust injector pulse-width to achieve the air/fuel ratio necessary for proper engine operation and to control emissions. The downstream sensor, located just after the catalytic converter, produces a similar signal input to the PCM, but is used to verify catalytic converter efficiency.

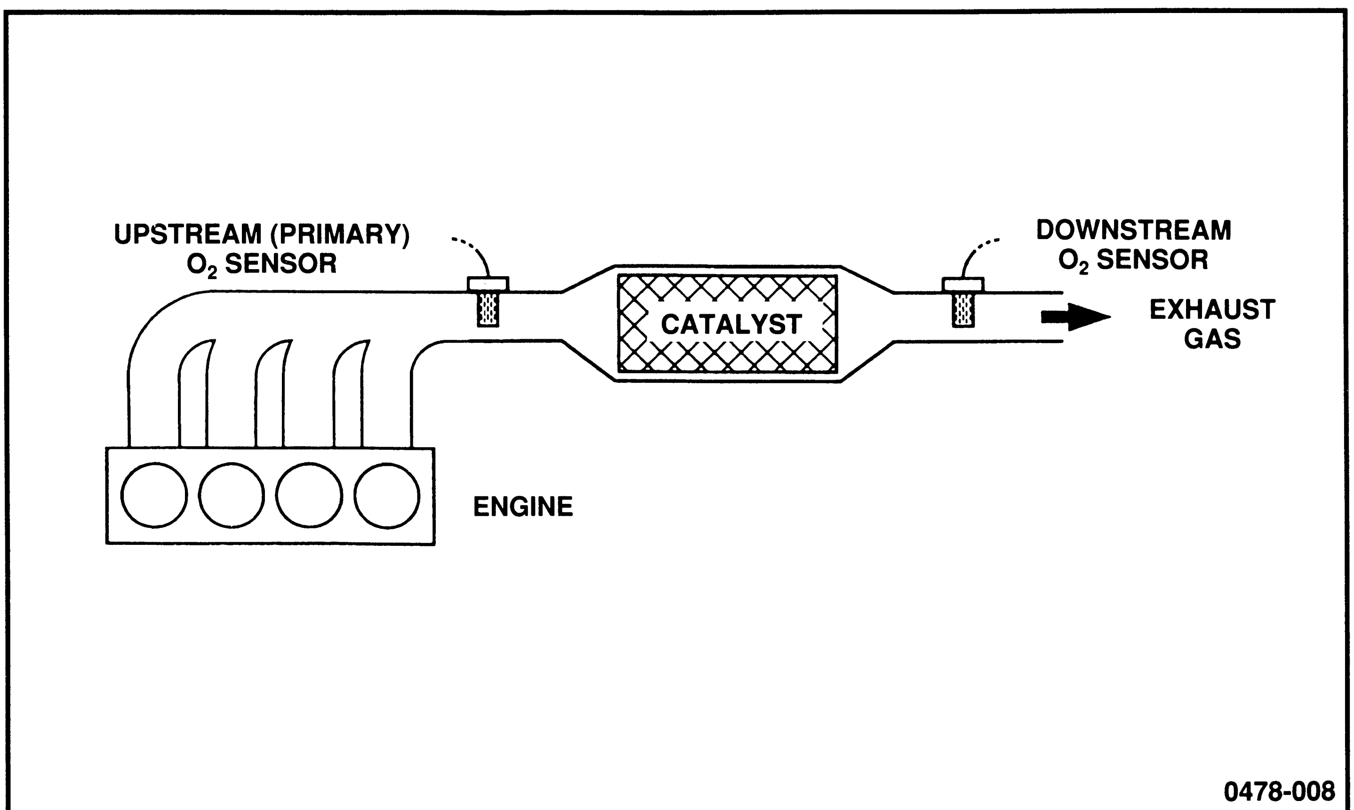


Figure 34 Oxygen Sensor Locations

Both O_2 sensors used on the Talon are zirconium dioxide, 4-wire, heated O_2 sensors. The heaters on both sensors are fed battery voltage from the ASD relay. Both sensor heaters uses a common ground. The upstream O_2 sensor's output wire is fed through pin 8, and the downstream sensor's output wire (MTX only) is fed through pin 7 (fig. 35).

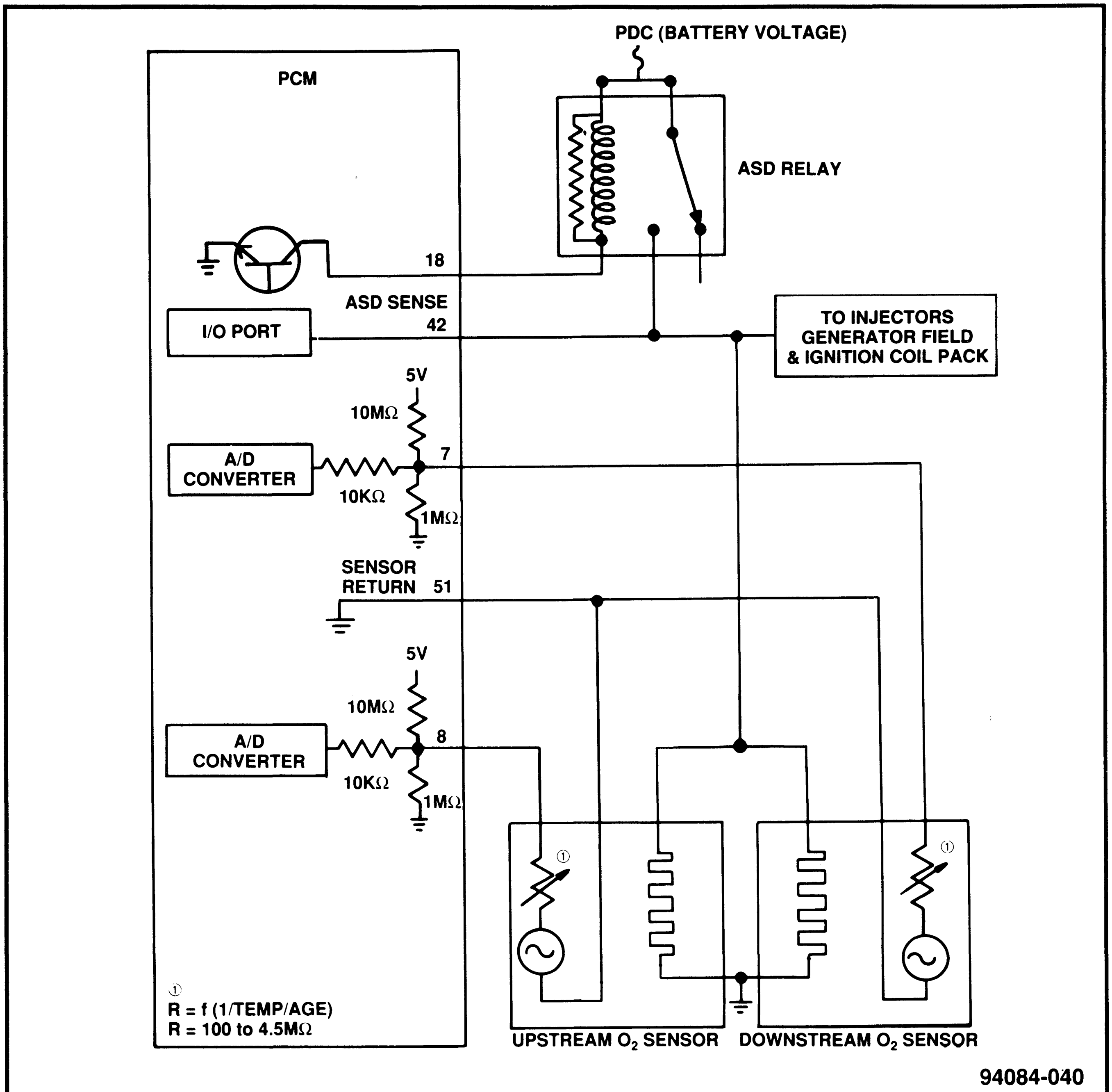


Figure 35 Dual O_2 Sensor Circuit

The ASD relay is energized any time there is a minimum rpm signal generated by the Crankshaft Position sensor, and also (on those vehicles with manual transaxles) during the O_2 sensor heater monitor test (engine off). The heater is a Positive Thermal Co-efficient (PTC) thermistor. As temperature increases, resistance decreases. At ambient temperatures around 70°F, the resistance of the sensor is approximately 6 ohms. When the O_2 sensor reaches its optimum temperature, the resistance is less than 1 ohm. This allows the heater to maintain the optimum operating temperature of approximately 930°-1100°F (500°-600° C).

The upstream O_2 sensor is used to maintain the air/fuel ratio at 14.7:1 (stoichiometric). The O_2 sensor must reach a minimum of 660° F. in order to effectively monitor $_{oxygen}$ content in the exhaust system. To provide optimum functioning of the O_2 sensor, the PCM waits until the system goes into closed loop before it controls the air/fuel ratio; it does not attempt to control the ratio immediately after a start-up.

Closed loop parameters are as follows:

- Engine temperature exceeds 35°F
- O_2 sensor is in the ready mode
- All timers have timed out, following the START to RUN transfer (the timer lengths vary, based upon engine temperature at key-on) as follows:
  - 35°F - 41 sec.
  - 50°F - 36 sec.
  - 70°F - 19 sec.
  - 167°F - 11 sec.

During closed loop, the feedback systems begin to operate. There are two feedback systems: one system is called "short term memory or correction," and the other is called "long term memory." These memories are comprised of 17 cells: 14 are purge-normal cells, and three are purge-free cells. Two of the cells are used only during idle. Each cell represents a manifold pressure and an rpm range. Talons with automatic transaxles use the cell structure shown in Table 3; those with manual transaxles use the structure shown in Table 4.

There are three "purge-free" memory cells that are used to identify the fuel vapor content of the evaporative canister. Since the evaporative canister is not purged 100% of the time, the PCM stores information about the evaporative canister's vapor content in a memory cell.

Table 3. Automatic Transaxle Memory Cells

ABOVE 1984 RPM	1	3	5	7	9	11	13 Idle Neutral
BELOW 1984 RPM	0	2	4	6	8	10	12 Idle Drive (ATX Only)

Map Sensor Voltage 1.38 2.0 2.64 3.26 3.9

Purge-free cells are cells that mimic purge normal cells. On a Talon with an automatic transaxle, the purge free cells are as follows:

1. Idle purge-free cell = Cell 12
2. Purge-free cell 2 = Cell 4
3. Purge-free cell 3 = Cell 3

Table 4. Manual Transaxle Memory Cells

ABOVE 1952 RPM	1	3	5	7	9	11	13 Idle Neutral
BELOW 1952 RPM	0	2	4	6	8	10	12 (not used)

MAP Sensor Voltage 1.38 2.0 2.64 3.26 3.9

The purge free cells for the Talon with a manual transaxle are as follows:

1. Idle purge-free cell = Cell 13
2. Purge-free cell 2 = Cell 4
3. Purge-free cell 3 = Cell 6

O_2 Sensor's Program

Once in closed loop, the upstream O_2 sensor indicates to the PCM the oxygen content in the exhaust. Short term fuel correction is used initially. Short term drives the pulse width (rich or lean) and looks for a response from the O_2 sensor. It begins with a quick change, then ramps slowly until the O_2 sensor's output voltage indicates the switch point of 0.45 volts (going rich) and 0.43 volts (going lean). At the switch point, the short term drives the pulse width with a sharp change in the opposite direction, and then ramps slowly until the switch point in the opposite direction is indicated (fig. 36). Short term memory keeps controlling the pulse width in this way until it no longer has control of the O_2 sensor switching. The short term memory can change pulse width from the amount programmed by other inputs by as much as 25%, positive or negative.

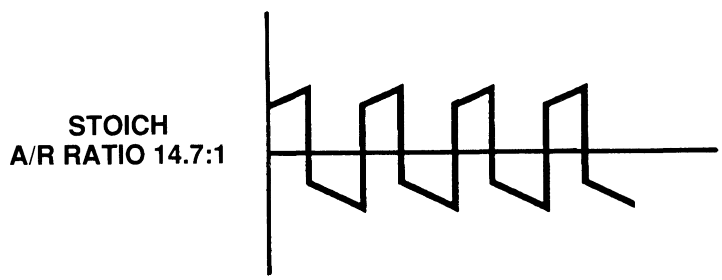


Figure 36 Short Term Fuel Compensation

Long term memory also has control over pulse-width, and can increase or decrease the pulse-width from the amount programmed by other inputs by as much as 25% positive or negative. Long term memory is retained by battery voltage, while short term is retained by ignition voltage. Every time ignition voltage is removed, short term memory is lost, whereas long term memory is lost only when the battery is disconnected (DRB III can also be used).

The long term memory works to bring the short term correction to the point where the average percent of short term correction in a specific memory cell is 0% (fig. 37). The long term memory returns to this level of pulse-width compensation the next time the PCM enters the same cell. In this way, the PCM is continually relearning the most appropriate level of control, even as the vehicle ages, the internal engine components wear, and operating conditions change.

Long term memory is driven by short term fuel correction. Long term memories do not update until the engine is fully warmed up. The information stored in the long term memory cells is used for pulse-width calculations throughout the operation of the PCM (open and closed loop).

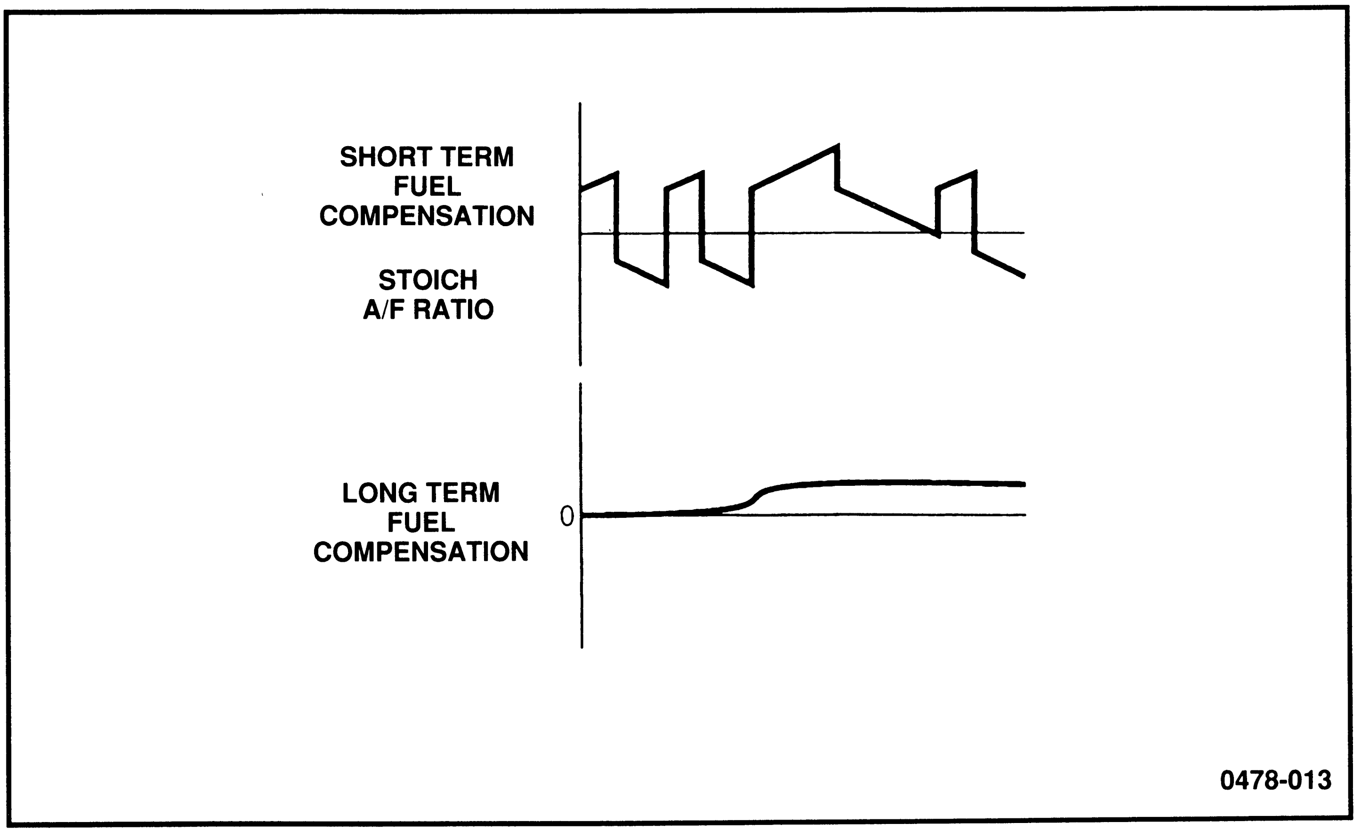


Figure 37 Long Term Memory Pulse Width Compensation

Downstream O_2 Sensor Programs (Manual Transaxle Vehicles Only)

With a normally functioning catalytic converter, the oxygen is stored or converted, and is used to break down the various chemicals that are produced during the normal combustion process (HC, CO, NO_x). As the catalytic converter,s plates break down or become coated, the oxygen storage ability decreases, allowing more O_2 to pass through the converter.

The downstream O_2 sensor measures the content of the O_2 passing through the catalytic converter. Normally, the downstream O_2 sensor's switch rate is extremely slow compared to the upstream sensor's rate. As the converter deteriorates, the O_2 sensor's switch rate increases. The PCM can compare the signals produced by the upstream and the downstream O_2 sensors to determine the operating efficiency of the catalyst (fig. 38). If the signal produced by the downstream sensor exceeds 70% of the signal value of the upstream sensor, the catalyst is faulty.

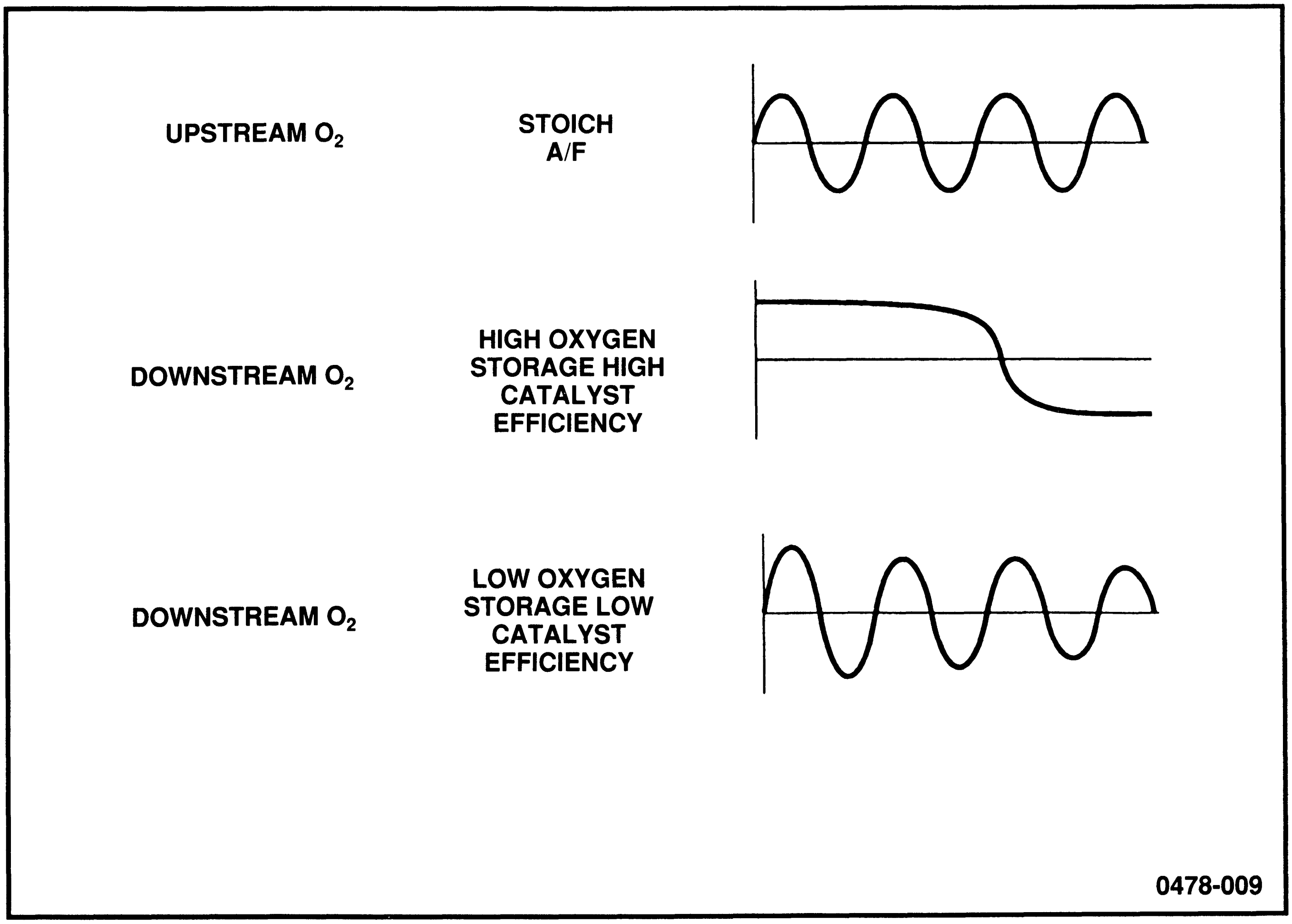
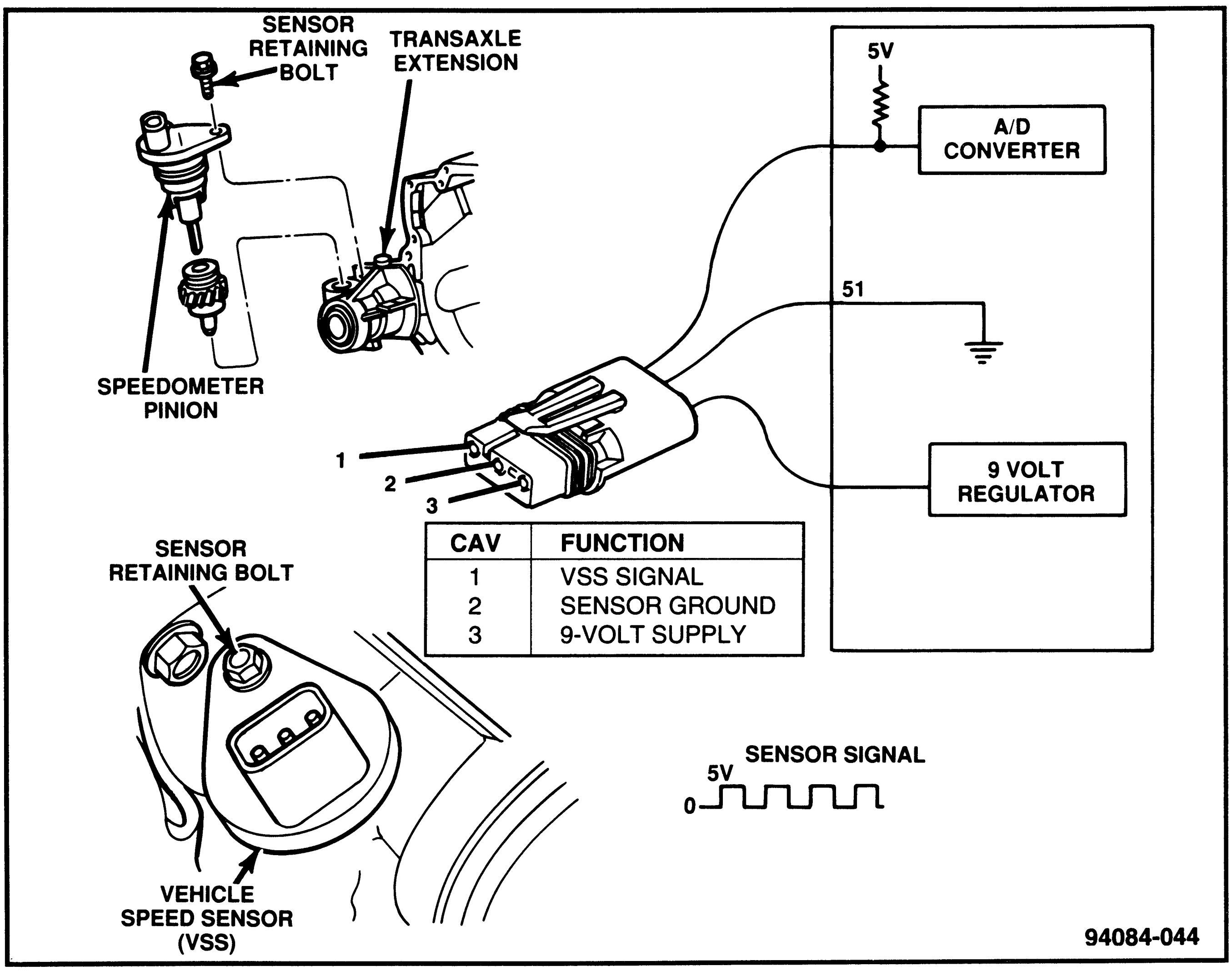


Figure 38 Upstream vs. Downstream O_2 Switch Rates

Vehicle Speed Sensor (VSS)

On vehicles equipped with manual transaxles, vehicle speed is transmitted to the PCM via the Vehicle Speed Sensor, which is located in the transmission's extension housing (fig. 39). On vehicles equipped with automatic transaxles, the Transmission Control Module (TCM) provides the VSS signal (fig. 40) electronically. The PCM requires the VSS to be able to control the following programs:

- Speed control
- IAC motor (during deceleration)
- Injection pulse width (during deceleration)
- OBD II diagnostics
- PCM mileage EEPROM



CAV	FUNCTION
1	VSS SIGNAL
2	SENSOR GROUND
3	9-VOLT SUPPLY

Figure 39 Manual Transaxle Vehicle Speed Sensor

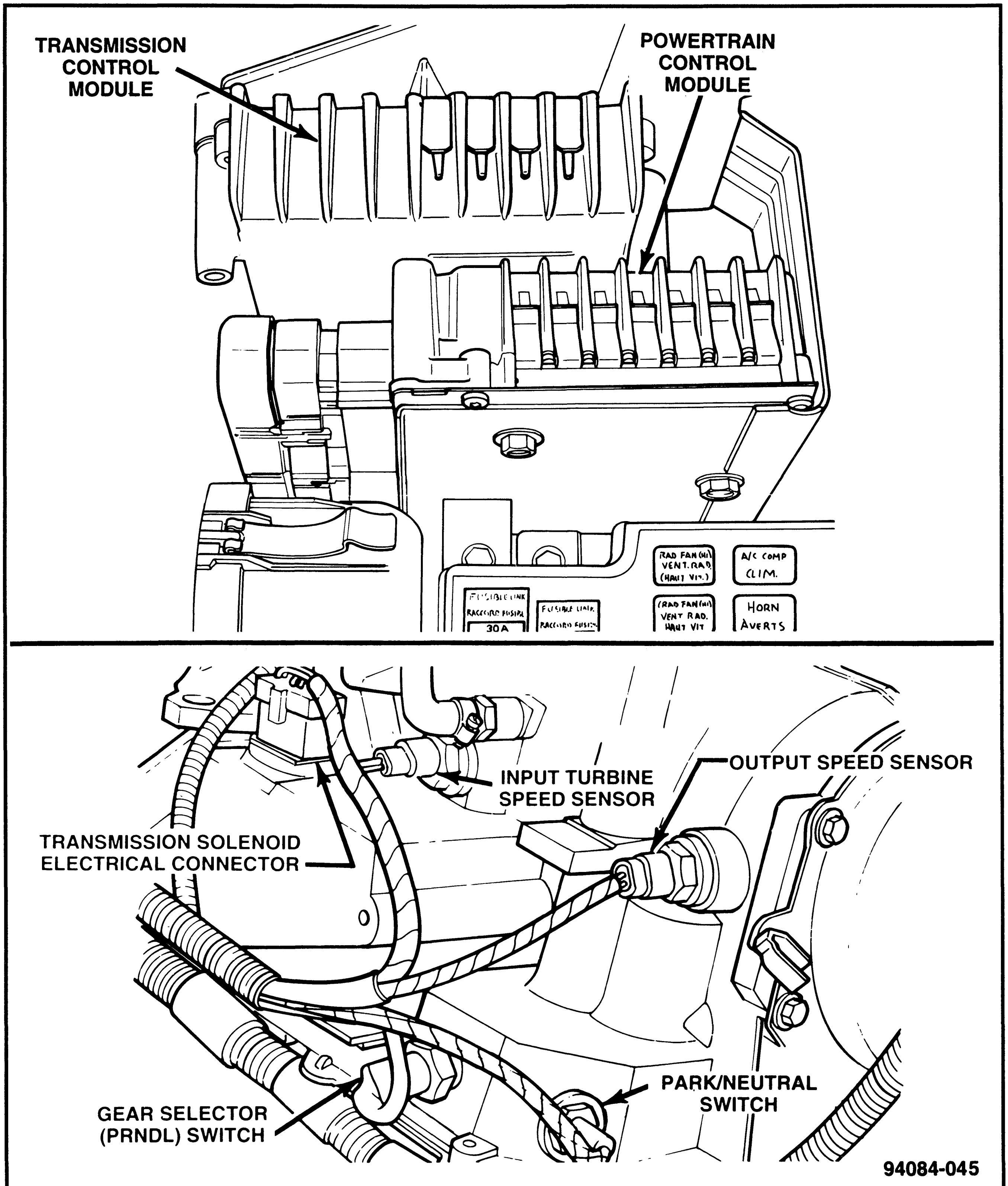


Figure 40 Automatic Transaxle Vehicle Speed Sensor Components

The VSS used on manual transaxle vehicles is a Hall-effect sensor. This sensor is mechanically driven by a pinion gear that is in mesh with the right axle drive shaft. The Hall-effect sensor switches a 5-volt signal sent from the PCM from a ground to an open circuit at a rate of four pulses per revolution. When the PCM counts 4000 pulses, the PCM assumes the vehicle has traveled one mile. 5 volts is fed from the PCM through pin 5, and the PCM provides a ground for the sensor through pin 51 (fig. 39).

Like all Hall-effect sensors, the electronics of the sensor needs a power source. This power source is provided by the PCM through pin 44. It is the same 9-volt power supply that is used by the CKP and CMP sensors (fig. 39).

Begining with the 1993 Eagle Vision, the TCM had provided VSS information on all vehicles equipped with a 42LE transaxle and has been designated "electronic pinion." The 1995 Eagle Talon is optionally equipped with a similar transaxle, called "F4AC1," which uses the electronic pinion as a VSS signal.

The term "electronic pinion" refers to the replacement of the pinion on the VSS with an electronic calibration programmed into the TCM. The electronic pinion is a system that allows the use of an existing VSS that is required to control shift points of the transmission.

The TCM uses an AC pulse generator to monitor transmission output-shaft speed. The 24 teeth on the output shaft are monitored by the output speed sensor. As the output shaft rotates, the output speed sensor provides an AC signal with a frequency in direct proportion to the 24 teeth on the output shaft. The TCM converts the AC sine-waves from the output speed sensor into an output shaft rpm signal. Once the TCM is programmed with information about tire size and axle ratios, the TCM delivers a signal to the PCM indicating vehicle speed.

The PCM sends a 5-volt signal from pin 5 to TCM pin 58 (fig. 41). The TCM switches this signal to a ground, and then opens the circuit at a rate of 4000 pulses per mile. The PCM calculates the VSS signal on an automatic transaxle vehicle the same way it does on a manual transaxle vehicle.

Previously, when owners changed the tire size on their vehicle, the speedometer pinion gear could be changed to accommodate the change in tire size for speedometer accuracy. On the Eagle Talon equipped with an automatic transaxle, the TCM can be programmed with information about tire size by using the DRB III. When programming the TCM, retrieve tire size information from the tire.

Note: *When the TCM is replaced, the new TCM must be programmed with tire size information in order to function. The TCMs are programmed not to output the VSS signal until the technician has prgramed tire size information. Refer to the DRB III reference book about TCM programing procedures.*

Note: *The VSS signal is used also by the instrument cluster to operate the odometer and the speedometer.*

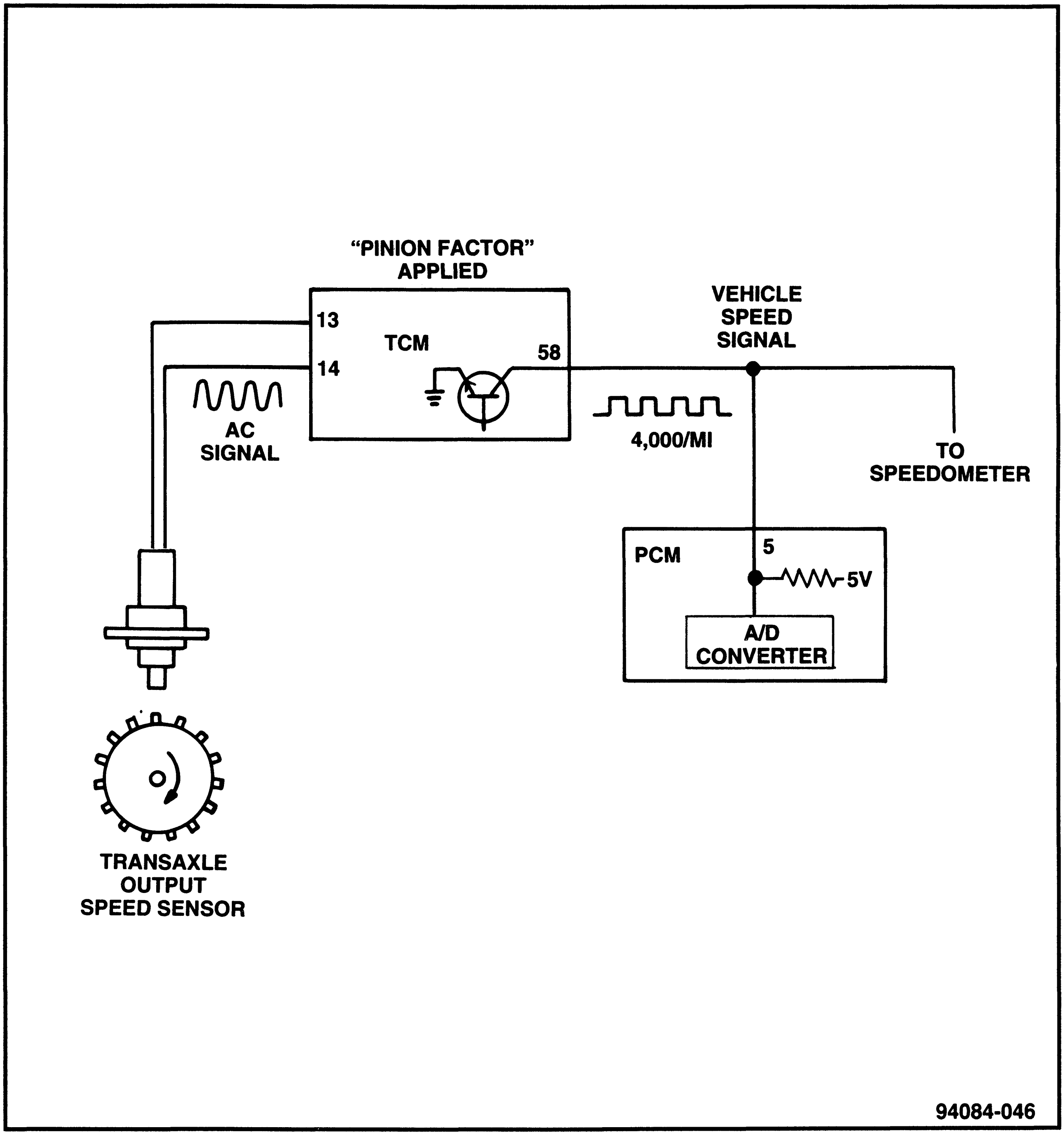


Figure 41 Automatic Transaxle Vehicle Speed Sensor Circuit

Brake Switch

The brake switch provides an input to the PCM to disengage the speed control when the brakes are applied. It is used also to influence transmission torque converter clutch disengagement, and as an indication identifying when the driver has depressed the brake pedal. Certain programs do not run if the brakes are applied (VSS DTC test).

The brake switch is equipped with two sets of contacts, one normally open and the other normally closed (brakes disengaged). The PCM sends a 9-volt signal to the normally closed switch, which is connected to a ground. The low-voltage signal monitored by the PCM indicates that the brakes are not applied. When the brakes are applied, the contacts open up, causing the PCM's output voltage to go high (fig. 42).

The normally open contacts are fed battery voltage. When the brakes are applied, battery voltage is supplied to the stop lamps and the speed control relay, if so equipped.

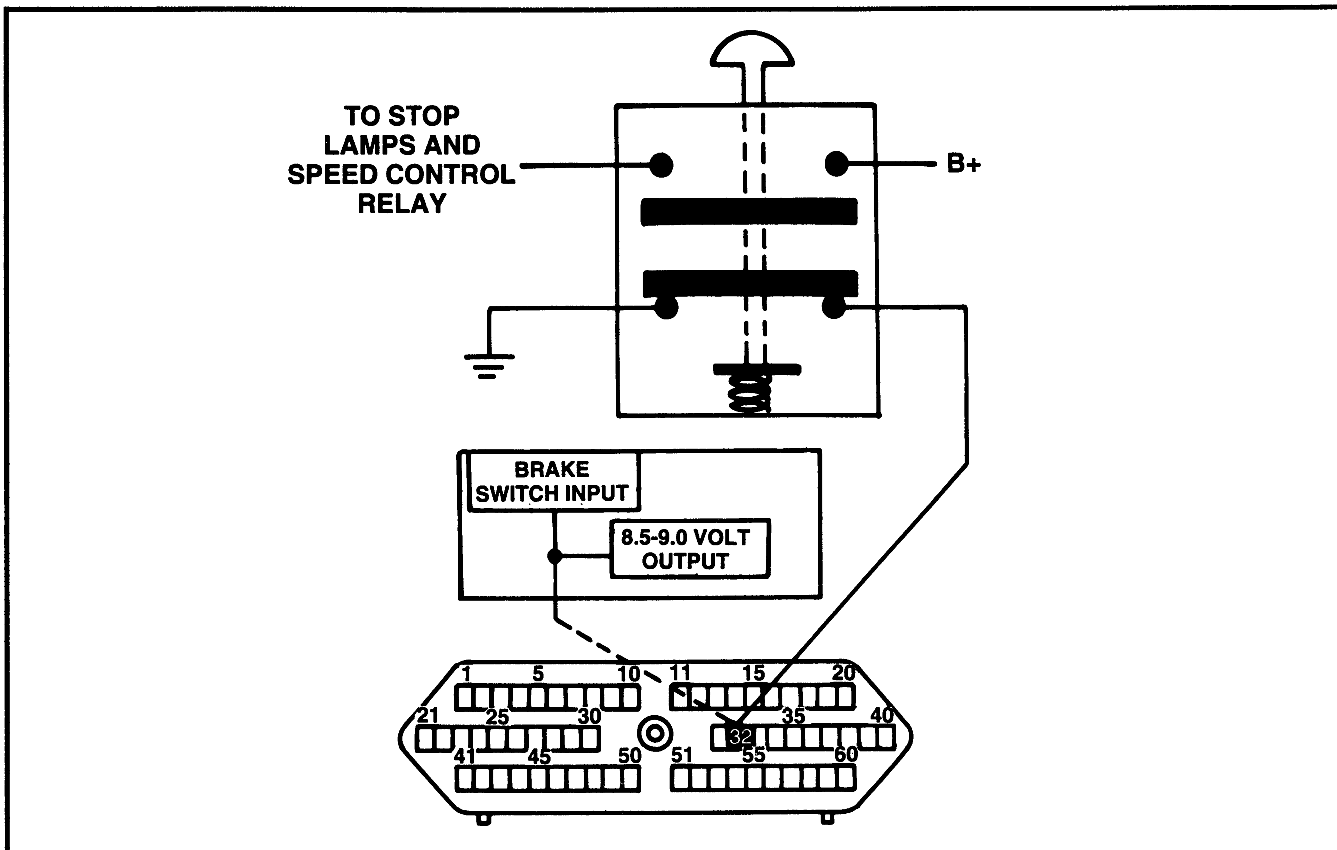


Figure 42 Brake Switch Circuit

Power Steering Pressure Switch

A pressure switch is located on the power steering pump. The switch signals periods of high pump load and high pressure, such as those that occur during parking maneuvers. This information allows the PCM to slightly raise and maintain target idle speed. To compensate for the additional engine load, the PCM increases air flow by adjusting the IAC motor.

The PCM sends a 12-volt signal to the power steering pressure switch through pin 56 (fig. 43). The switch is normally open, so when there is a high pump load, the switch contacts close to ground.

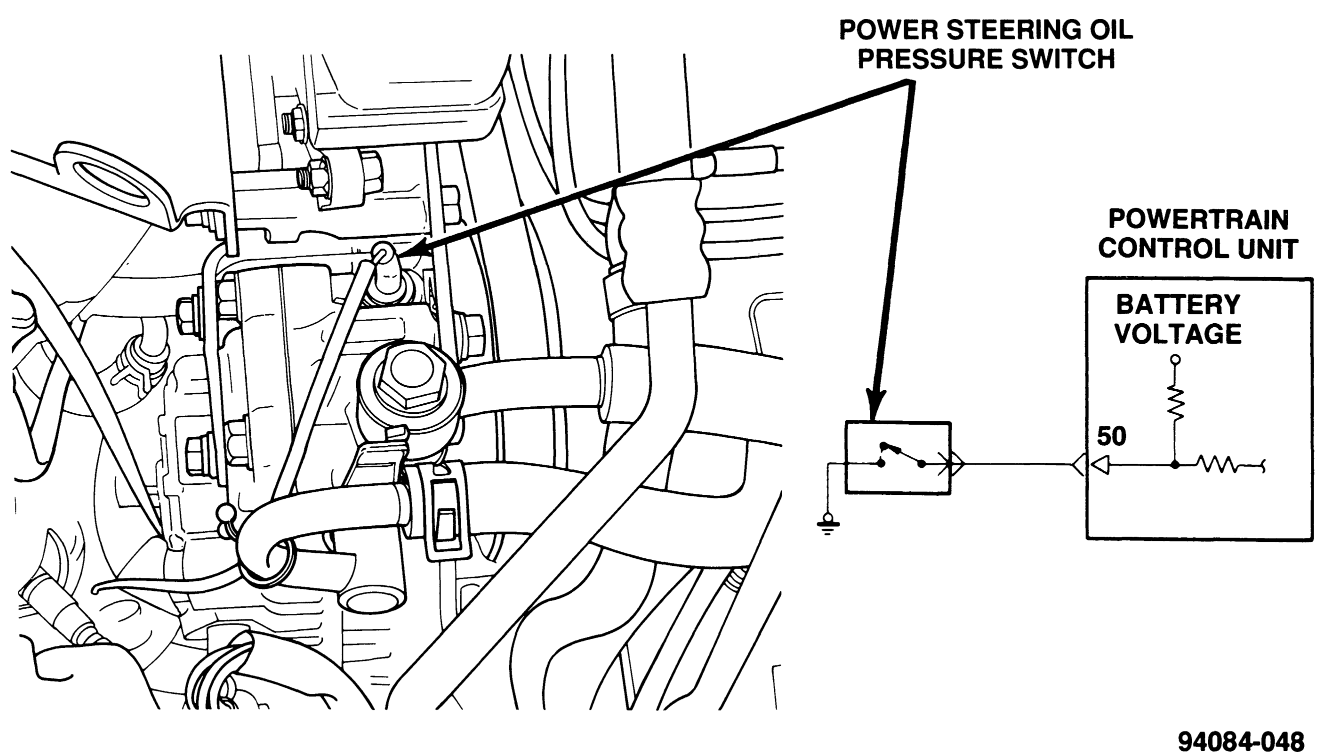


Figure 43 Power Steering Pressure Switch

Speed Control Switches

The speed control switches (fig. 44) provide inputs to the PCM to indicate the speed control modes: On, Off, Set, Resume, Cancel, Accelerate, Decelerate. There are two separate switches that operate Talon's speed control. A steering-column-mounted switch uses a multiplexed circuit to provide inputs to the PCM for Resume, Accelerate, Set, Decelerate, and Cancel modes. An ON/OFF switch, mounted on the left side of the instrument panel, provides battery voltage to the PCM to indicate ON and OFF. It also provides power to operate the speed-control servo and the speed-control light.

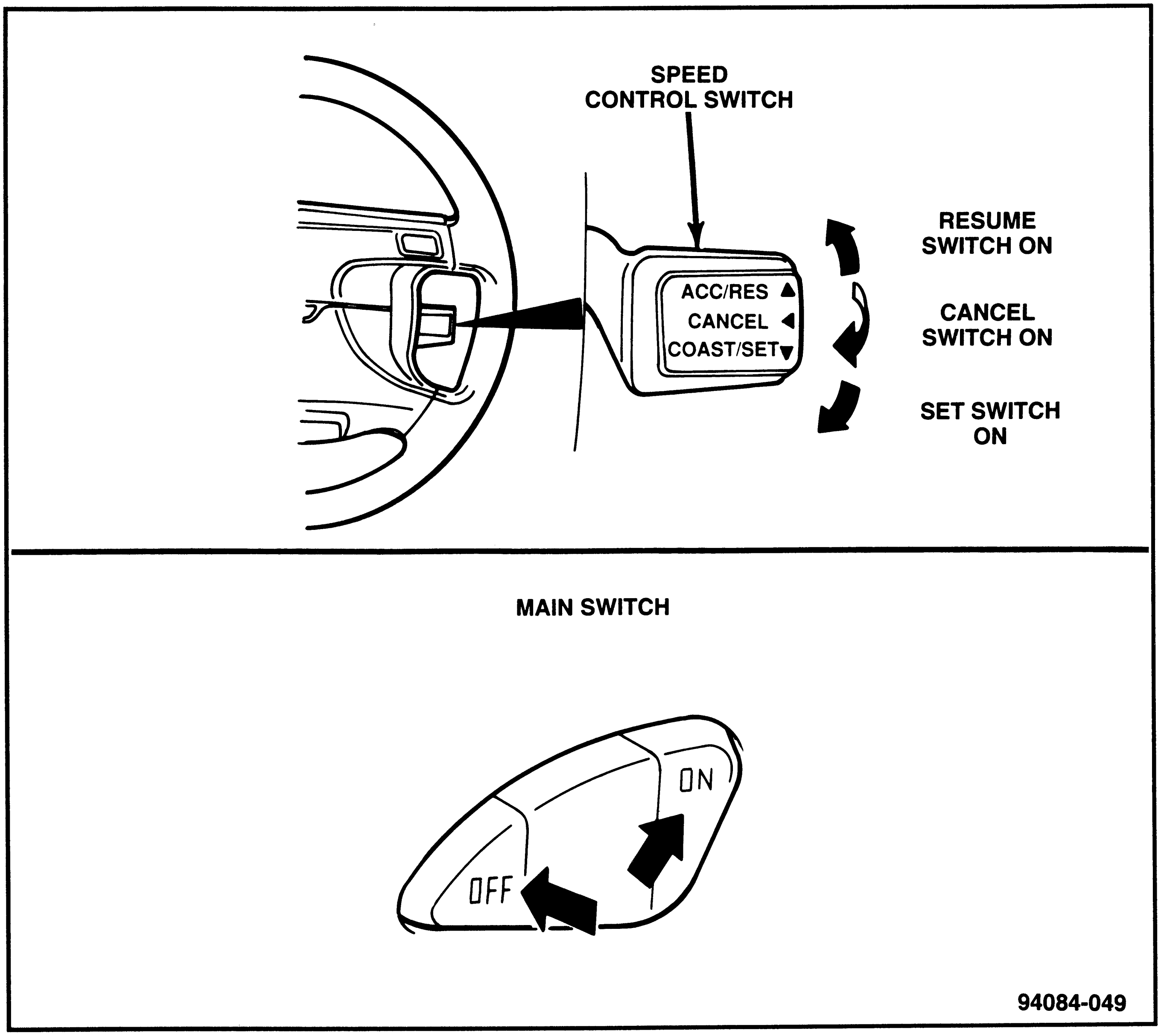


Figure 44 Speed Control Switches

When speed control is selected by depressing the ON/OFF switch, the PCM allows a set speed to be stored in the RAM for speed control. To store a set speed, depress the COAST/SET switch while the vehicle is moving at a speed between 30 and 80 mph. In order for the speed control to engage, the brakes cannot be applied, nor can the gear selector be indicating the transmission is in Park or Neutral.

The speed control can be disengaged manually by:

- Stepping on the brake pedal
- Depressing the ON/OFF switch
- Depressing the CANCEL switch

The speed control can be disengaged also by any of the following conditions:

- An indication of Park or Neutral
- The VSS signal increases at a rate of 10 mph per second (indicates that the coefficient of friction between the road surface and tires is extremely low)
- An rpm increase without a VSS signal increase (indicates that the clutch has been disengaged)
- Excessive engine rpm (indicates that the transmission may be in a low gear)
- The VSS signal decreases at a rate of 10 mph per second (indicates that the vehicle may have decelerated at an extremely high rate)

The previous disengagement conditions are programmed for added safety.

Once the speed control has been disengaged, depressing the ACC/RES switch restores the vehicle to the target speed that was stored in the PCM's RAM.

Note: *Depressing the ON/OFF or the CANCEL switch will erase the set speed stored in the PCM's RAM.*

If, while the speed control is engaged, the driver wishes to increase vehicle speed, the PCM is programmed for an acceleration feature. With the ACC/RES switch held closed, the vehicle accelerates slowly to the desired speed. The new target speed is stored in the RAM when the ACC/RES switch is released. The PCM also has a "tap-up" feature in which vehicle speed increases at a rate of approximately 2 mph for each momentary switch activation of the ACC/RES switch.

The PCM also provides a means to decelerate without disengaging speed control. To decelerate from an existing recorded target speed, depress and hold the COAST/SET switch until the desired speed is reached. Then release the switch. The ON/OFF switch operates three components: the PCM's ON/OFF input, the speed control ON/OFF light (on the instrument panel), and the battery voltage to the speed control relay, which operates the speed control servo (fig. 45).

When the ON/OFF switch contacts are closed, battery voltage is supplied to PCM pin 55, which indicates that speed control is desired. At the same time, battery voltage is supplied to the speed control relay and to the speed control light, which is illuminated any time the ON/OFF switch contacts are closed. The relay contacts are normally closed, so when the ON/OFF switch is engaged, battery voltage is supplied to the speed control servo. When the brakes are applied, the relay is energized, causing the contacts to open, removing battery voltage from the servo.

The speed control switch mounted on the steering column contains three switches and two resistors. The PCM sends 5 volts through pin 31 to the speed control switch, which is grounded through PCM pin 51. The input on pin 31 is responsible for identifying the following: Resume, Set, Accelerate, Decelerate, and Cancel. This is accomplished by multiplexing. Multiplexing allows the PCM to identify more than one signal from a single wire. To accomplish this, the speed control switch uses resistors that cause different voltage signals at pin 31.

The 5-volt signal at pin 31 has no path to ground when no contacts are closed. If the COAST/SET switch is pressed, a momentary contact closes a path to ground through a 2,700 ohm resistor. This causes a voltage change at pin 31, indicating that the COAST/SET switch has been pressed. When the ACC/RES switch is depressed, a momentary contact closes to ground through an 820 ohm resistor. The 5-volt signal then passes through a lower resistance than that of the COAST/SET switch, causing the voltage to be lower than that of the COAST/SET signal. When the CANCEL switch is depressed, the contacts close directly to ground, causing the 5-volt signal to drop to 0 volts.

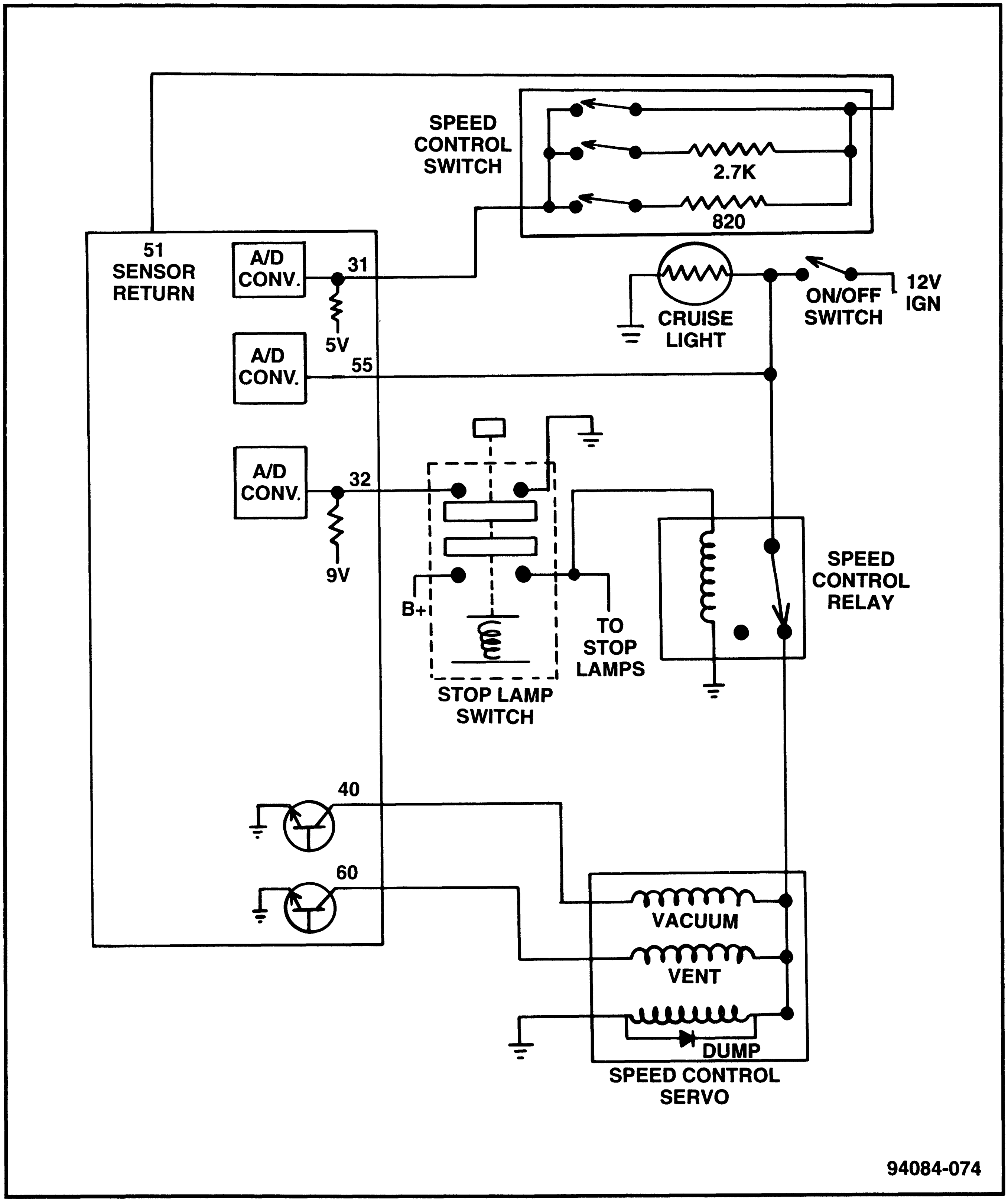


Figure 45 Speed Control Circuit

Air Conditioning Components

Several components are involved with allowing the A/C compressor to function. The PCM controls the A/C relay by monitoring the A/C sense circuit. The sense circuit involves the components listed in Table 5.

Table 5. A/C Sense Circuit Inputs

COMPONENT	LOCATION
Blower Switch	Instrument Panel (fig. 46)
A/C Switch	Instrument Panel (fig. 46)
A/C Automatic Compressor Controller (includes compressor lock logic)	Right Side of the Evaporator housing (fig. 47)
Evaporator Fin Thermal Sensor	Evaporative Housing (fig. 48)
Air Inlet Thermal Sensor	Evaporator Housing (fig. 48)
Tachometer Input	Input to Automatic A/C Compressor Controller
Compressor Revolution Sensor	On Compressor (fig. 49)
Dual Pressure Switch	Engine Compartment on the Left Side
Powertrain Control Module	Engine Compartment on the Left Side (fig. 17)

Blower Switch

The blower switch has four possible motor speed selections (LO, MED 1, MED 2, and HI). The blower switch also has an OFF position (fig. 46). In order to use the defrost or A/C functions, the blower must be in one of the four speed positions. The blower motor electrical circuit also includes a resistor and two relays (one for HI speed and one for the other three speeds).

A/C Switch

The A/C switch must be pushed to the ECONO (halfway in) or A/C position (all the way in) for the air conditioner system to operate (compressor engaged) (fig. 46). An LED in the switch is illuminates yellow when the ECONO position is selected, or green when the A/C position is selected. The A/C switch is part of the auto compressor control systems. Pushing the A/C switch to ECONO position raises the temperature point of which the compressor clutch cycles on and off. This allows the compressor to be engaged only when necessary, which may increase fuel economy while using the air conditioning system.

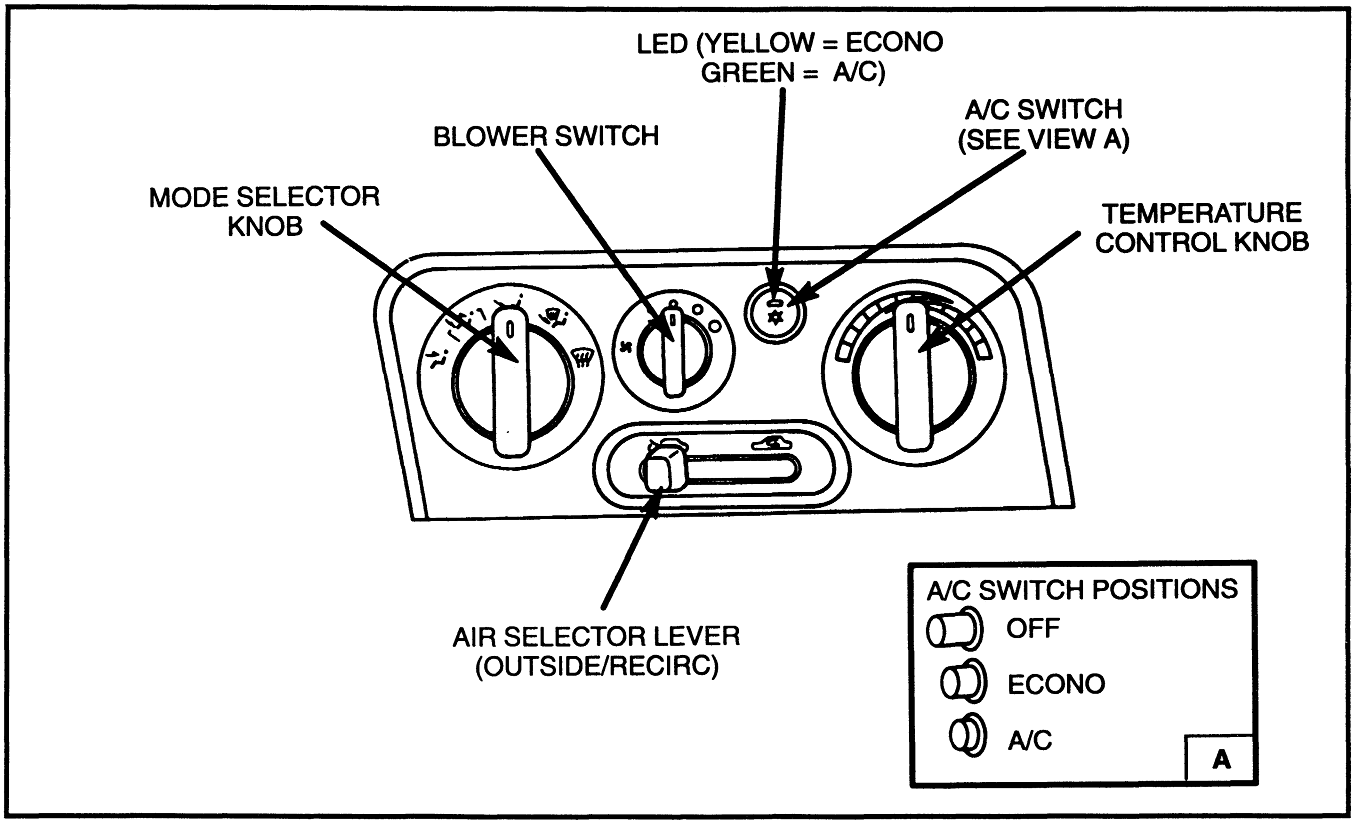


Figure 46 A/C and Blower Fan Controls

Auto Compressor Control System

The auto compressor control system is controlled by the auto compressor control module (fig. 47), which is located under the blower motor assembly. Input signals from the air thermo sensor and fin thermo sensor (fig. 48) are used to control the ON/OFF functions of the compressor magnetic clutch. The air thermo sensor measures the temperature of the air entering the evaporator, while the fin thermo sensor measures the temperature of the evaporator. These signals, plus operator inputs from the A/C control head, are used by the auto compressor control module to determine when the compressor magnetic clutch should be engaged. The purpose of this system is to engage the compressor clutch only when necessary to keep interior temperatures at the desired operator setting during A/C operation.

The auto compressor control module compares engine rpm inputs to the speed signal generated by a compressor revolution pick-up sensor (fig. 49). If the difference between the two signals exceed the value programmed into the control module (indicating compressor lock-up), the control module shuts off the compressor. This prevents the engine accessory belt from being broken due to slipping when the compressor locks-up. To notify the driver that the compressor locked-up, the LED on the A/C control panel flashes.

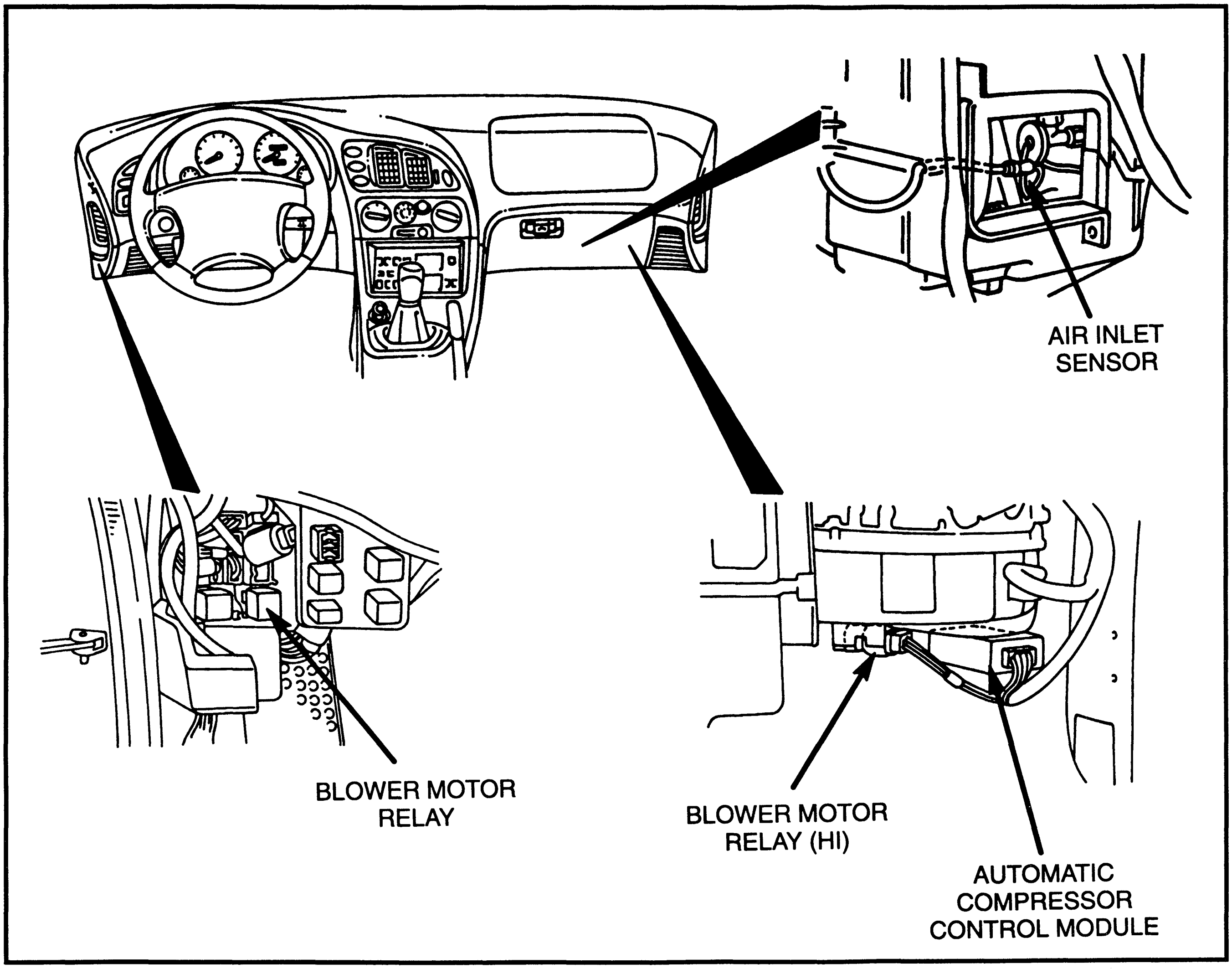


Figure 47 Passenger Compartment Components

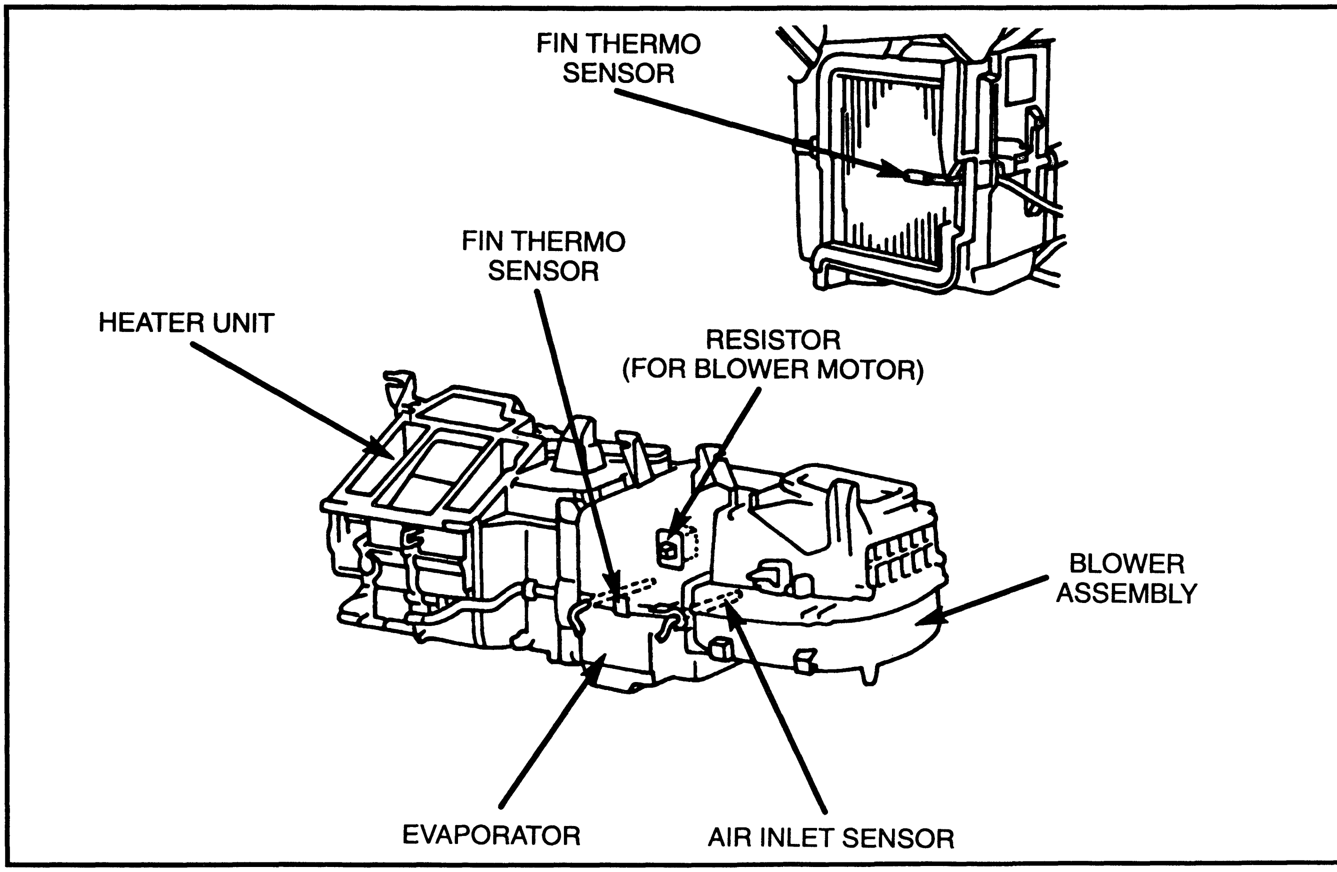


Figure 48 Evaporator Housing

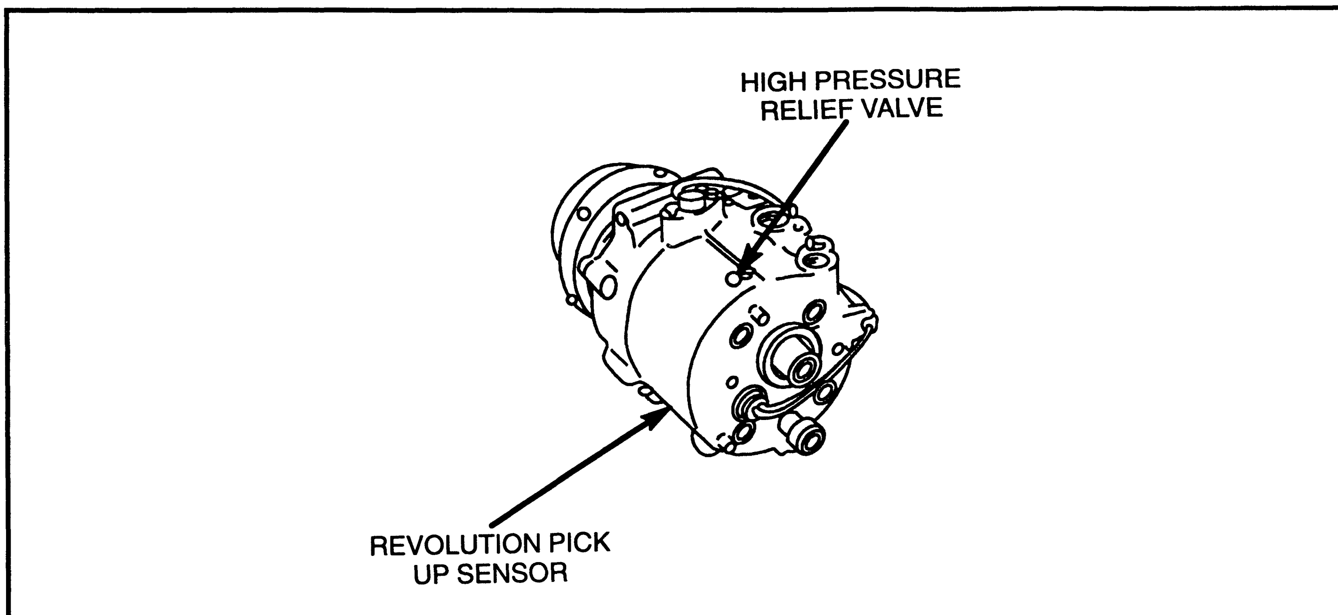


Figure 49 A/C Compressor

Auto Compressor Control Module Inputs

The inputs for the auto compressor control module are as follows (fig. 50):

- Power Supply and Ground - Battery voltage is provided to the auto compressor control module through terminal five any time the ignition switch is in the run position and a ground is provided through terminal two.

- A/C Switch - The A/C switch is fed battery voltage anytime the blower switch signal is positioned in any of the four blower fan speeds (fig. 50). When ECONO is selected from the A/C switch, battery voltage is applied to terminal four of the auto compressor control module. When FULL A/C is selected, battery voltage is applied to terminal 13. These inputs are used by the auto compressor control module to initialize A/C operation.

- Air Thermo Sensor - The air thermo sensor is used as an ambient temperature input to the auto compressor control module (fig. 51). This input is used in conjunction with the fin thermo sensor to engage the compressor clutch at the appropriate temperature ranges. The auto compressor control module sends a 5-volt reference signal through terminal 14 to the air thermo sensor. The sensor return is sent through terminal six of the auto compressor control module. The sensors resistance changes with the temperature of the air thus causing a change in voltage at terminal 14 as temperature changes.

- Fin Thermo Sensor - The fin thermo sensor is used to identify the temperature of the evaporator (fig. 51). It is used in conjunction with the air thermo sensor to engage the compressor clutch at the appropriate temperature ranges. The auto compressor control module sends a 5-volt reference signal to the fin thermo sensor. The sensor return is sent through terminal eight of the auto compressor control module. As temperatures of the evaporator change, the resistance of the sensor changes, thus causing a change in voltage at the signal input to the auto compressor control module.

- Revolution Pick-up Sensor - The revolution pick-up sensor is used by the auto compressor control module to prevent the belt from slipping due to a compressor that seized (locked) up. The control module removes the A/C request signal from the PCM when a belt slipping rate of 70% or more is indicated. Terminals seven and eight are used as inputs to the auto compressor control module to identify compressor shaft speed (fig. 51).

- A/C Compressor ON Signal - This signal is used by the auto compressor control module to identify whether or not the A/C compressor relay is energized or not. Through terminal one, system voltage is supplied as long as the A/C compressor relay is energized.

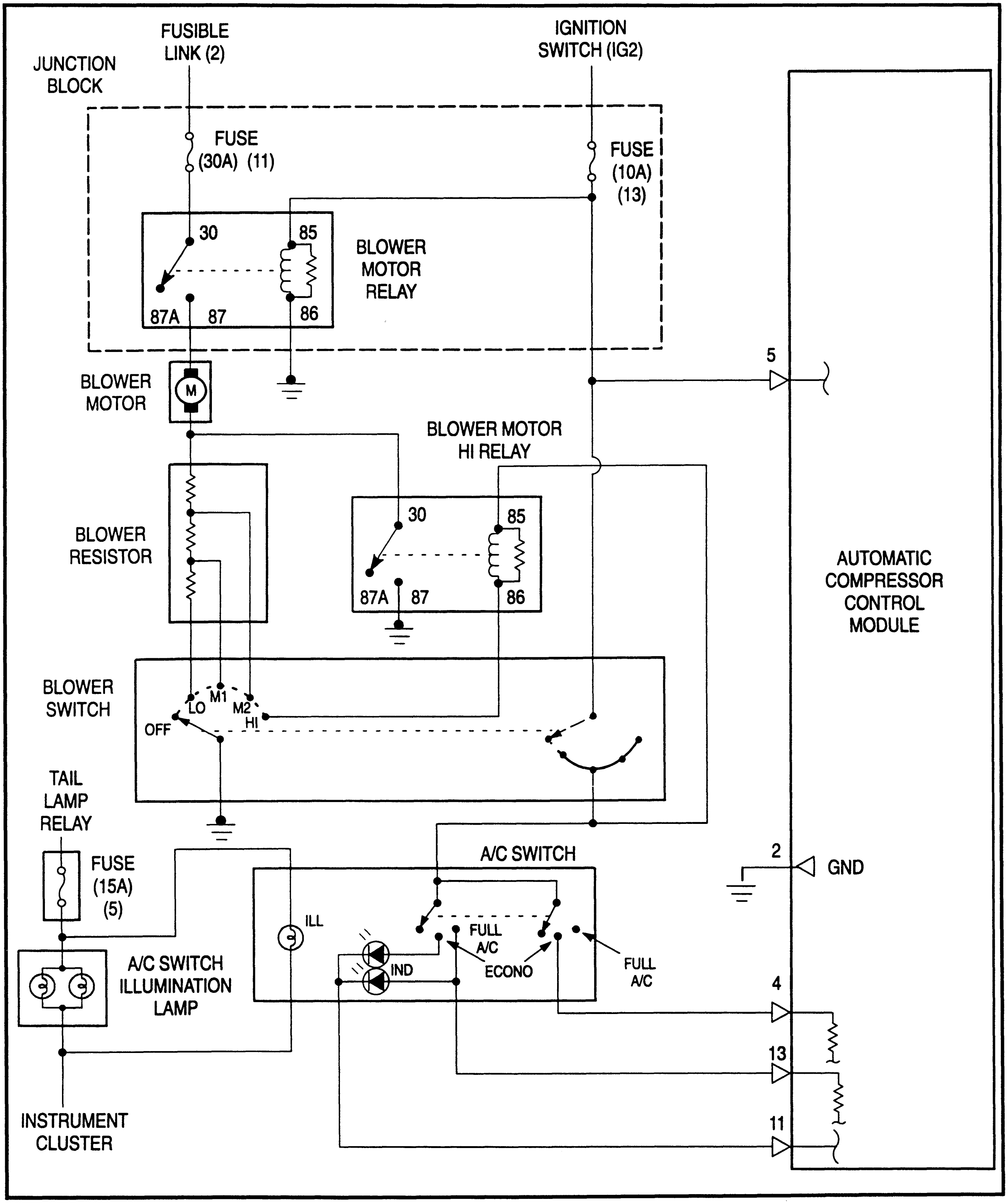


Figure 50 Automatic Compressor Control Module Circuit

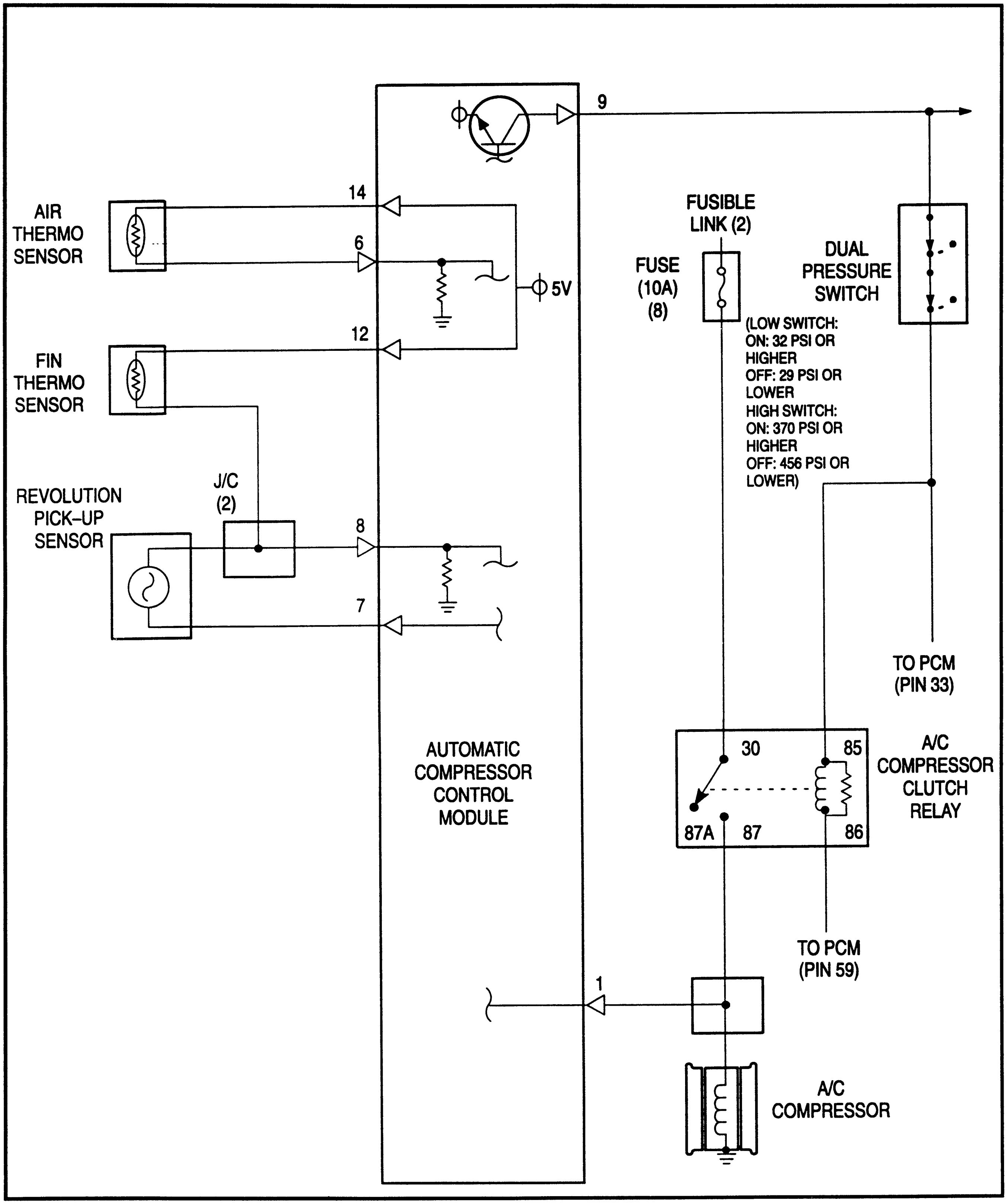


Figure 51 A/C Request Signal

Auto Compressor Control Module Outputs

The main output of the auto compressor control module is the A/C request signal (fig. 51). A signal is sent through terminal nine anytime that the auto compressor control module requires the compressor to be engaged. The request signal is ON as long as A/C has been selected, and the air thermo sensor and the fin thermo sensor are indicating temperatures within the parameters as indicated in figure 52. Also, the compressor revolution sensor cannot be indicating that the belt is slipping.

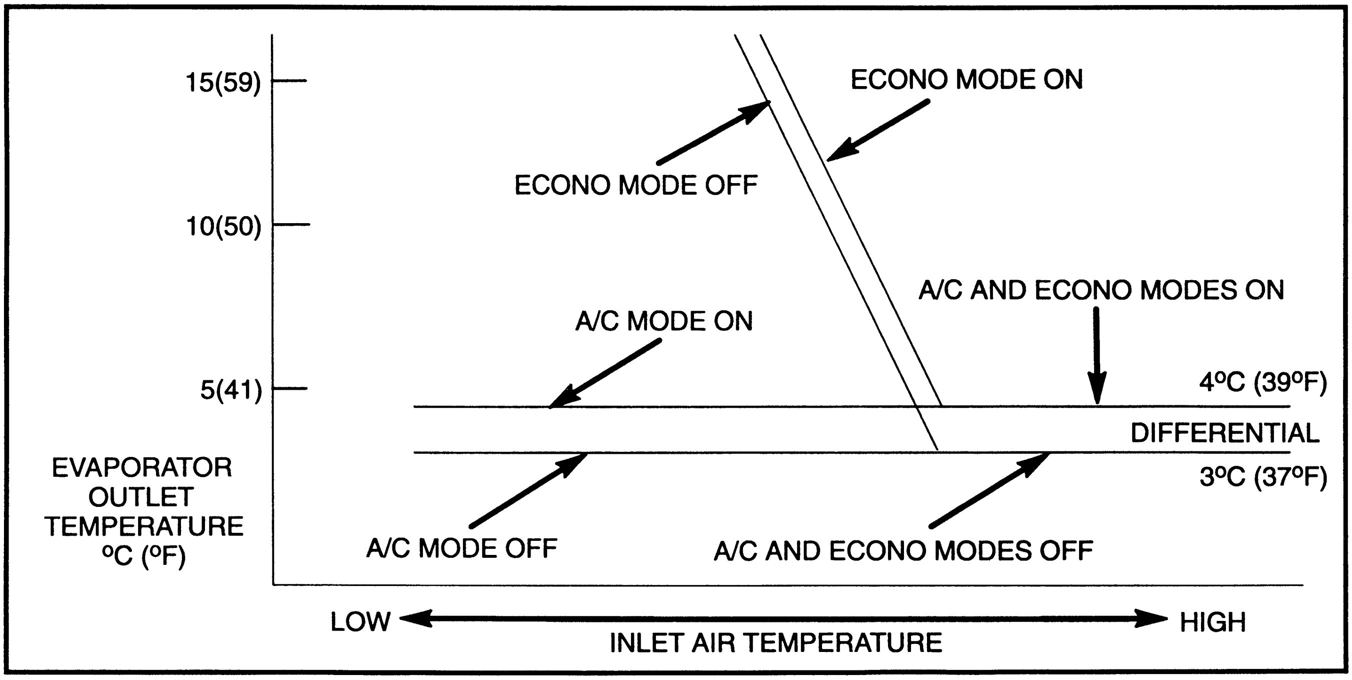


Figure 52 A/C Compressor Cycling Parameters

When the auto compressor control module sends the request signal ON, system voltage passes through terminal nine to the A/C condenser fan relay. With the request signal ON, the A/C condenser fan relay should be energized.

With the request signal ON, terminal nine also provides system voltage to the dual pressure switch. The dual pressure switch is located on the receiver/drier assembly, and is used to protect the compressor from high or low pressure conditions. The LOW switch is ON (closed) at 32 psi (220 kpa) or higher, and OFF (open) at 29 psi (200 kpa) or lower. The HIGH switch turns OFF (open) at 456 psi (3,140 kpa) or higher, which removes power supplied to the compressor clutch relay. The HIGH switch turns ON (closed) at 370 psi (2,550 kpa) which re-engages the compressor clutch.

With both the LOW and HIGH pressure switch contacts closed, system voltage is supplied to the A/C compressor relay electromagnet and PCM terminal 33. Once the

PCM recognizes the request signal and the PCM's other monitored inputs indicate that the A/C compressor should be engaged, the PCM provides a ground for the A/C relay's electromagnet. With the relay energized, battery voltage is supplied to the compressor clutch coil and also to terminal one of the auto compressor control module.

Park/Neutral Switch (Auto Transaxle Only)

The Park/Neutral switch on vehicles with automatic transaxles is located on the transaxle housing (fig. 53). The Park/Neutral switch uses the same contacts as the starter relay, and provides a path to ground when the vehicle is shifted into PARK or NEUTRAL.

The PCM uses information from the Park/Neutral switch to calculate the following:

- Spark-advance programs
- Injector pulse-width programs (long term memory cells 12 and 13)
- Speed control disengagement
- Target idle (see p. 40)
- Anticipation of the load increase

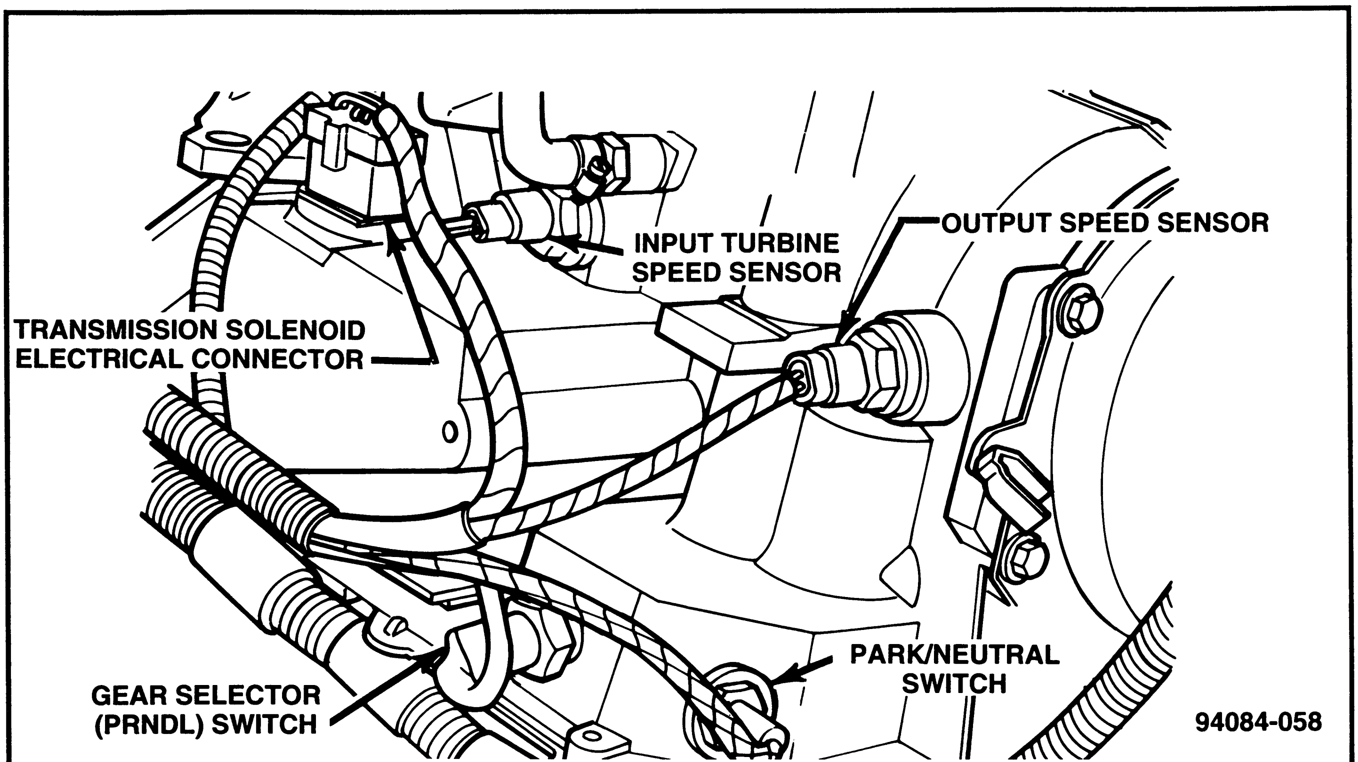


Figure 53 Park/Neutral Switch

The PCM delivers 9 volts to the center terminal of the Park/Neutral switch through pin 50 of the 60-way connector (fig. 58). When the gear shift lever is moved to either the PARK or the NEUTRAL position, the PCM receives a ground signal from the Park/Neutral switch. With the shift lever positioned in DRIVE or REVERSE,the Park/Neutral switch contacts open, causing the signal to the PCM to go high.

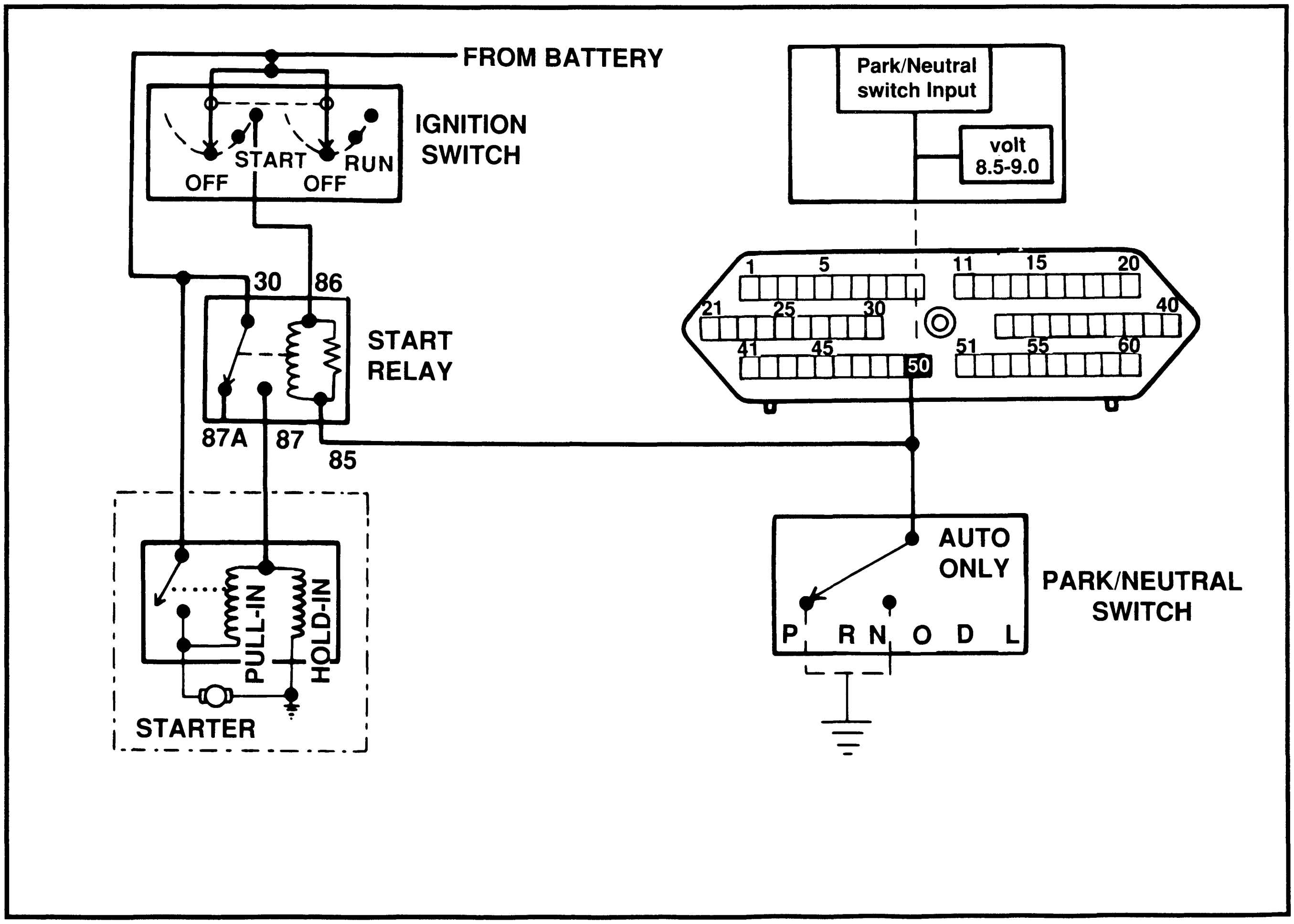


Figure 54 Park/Neutral Switch Circuit

Battery Temperature Sensor

The PCM incorporates a Battery Temperature Sensor (BTS) on its circuit board. The function of the BTS is to enable control of the generator output based upon ambient temperature. As temperature increases, the charging rate should decrease. As temperature decreases, the charging rate should increase. The PCM maintains the maximum output of the generator by monitoring battery voltage and controlling battery voltage to a range of 13.5-14.7 volts.

ASD Sense Circuit

The PCM receives a battery voltage signal at pin 42, indicating that the Automatic Shut Down (ASD) relay has energized. It uses this input for diagnostic purposes. The PCM provides the relay coil with a path to ground as an output function. Refer to the Output Section on the ASD relay for more information.

C^2D Bused Messages

Talons with an F4AC1 automatic transaxle use information collected by the PCM. This information is then delivered to the Transmission Control Module (TCM) over a data bus called the "Chrysler Collision Detection" (C^2D) system. The TCM uses several pieces of information that the PCM already has available. Instead of having both controllers receive the same inputs, the PCM receives the input, and then sends the information to the TCM. The following is a list of bused messages that are sent to the TCM:

- Engine rpm
- Manifold pressure
- Barometric pressure
- Throttle position
- Vehicle speed
- Engine temperature
- Battery temperature
- Target idle
- Engine model
- Cumulative mileage (used to identify when the DRB III is used for diagnostics)
- Engine coolant temperature and battery temperature limp-in status
- Vehicle identification number

This information is used by the TCM to ensure quality shift points during all operation modes. For more information pertaining to the F4AC1 automatic transaxle, refer to the course offered by Technical Training.

PCM Outputs

Malfunction Indicator Lamp (MIL)

The MIL (CHECK ENGINE) lamp is located in the Talon's instrument cluster (fig. 55). Because vehicles with manual transaxles contain an upgraded on-board diagnostic system (OBD II), the MIL can illuminate under a greater number of conditions than on previous models. Automatic transaxle vehicles are equipped with California-certified on-board diagnostics (OBD I).

The MIL is operated by the PCM, and illuminates for a three-second bulb test each time the ignition is turned to ON. The MIL lamp remains continuously illuminated when an emissions component fails, or the vehicle enters the limp-in mode. In the limp-in mode, the PCM provides programmed inputs to keep the vehicle operational.

If the vehicle is equipped with OBD II diagnostic capabilities, the MIL flashes if the on-board diagnostic system detects engine misfire severe enough to damage the catalytic converter. The vehicle should not be driven if this occurs. Finally, the MIL may be used also to access flash Diagnostic Trouble Codes (DTCs).

Any time the MIL is illuminated, a DTC is stored. Once the MIL illuminates, the PCM must meet certain criteria to extinguish the lamp. Previously, on vehicles equipped with OBD I diagnostics, the MIL extinguishes only after the problem that caused the MIL to illuminate is repaired, and the key has been cycled from OFF to ON one time. For vehicles equipped with OBD II diagnostics, the following conditions must occur three consecutive time to extinguishe the MIL.

- O_2 and EGR monitors must be run before it can test a comprehensive component or system as a "good trip." (See the On Board Diagnostic Student Reference Book for detailed information.)
- Once the monitors have been run, the component or system must be tested good to be considered as passing the trip.

If a problem occured with one of the main monitors, the PCM must pass the test of the monitor that failed three consecutive times before the MIL is extinguished.

DTCs that were stored can be automatically erased only after the MIL has been extinguished.

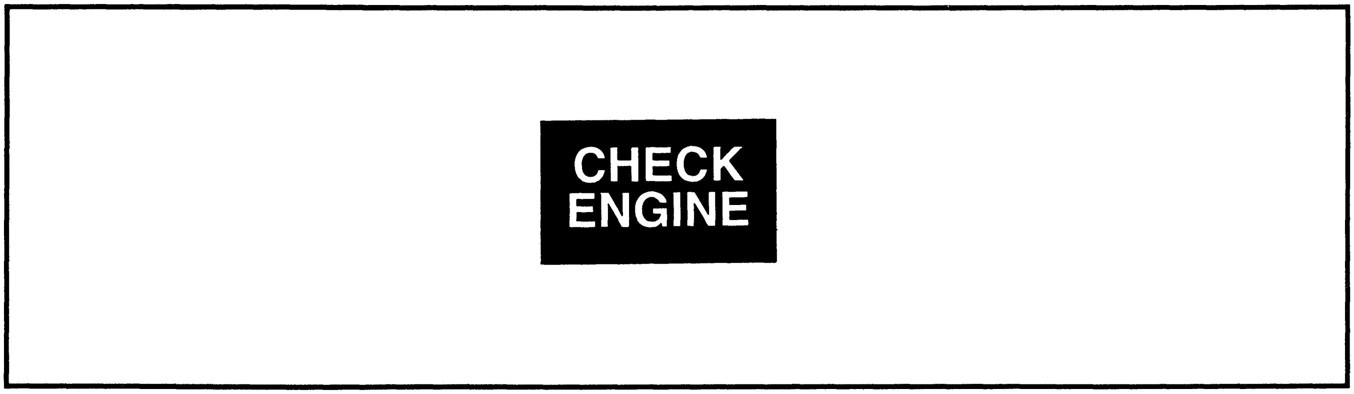


Figure 55 Instrument Panel Malfunction Indicator Lamp (MIL)

Data Link Connector

The PCM maintains communication with scan tools through the vehicle's Data Link Connector (DLC) (fig. 56). The Talon incorporates both the previous 12-way DLC and a new 16-way DLC for use with the new DRB III diagnostic scan tool. A special "Y" connector must be used in conjunction with the DRB III, but the MMC adapter that was previously used is not required. The DLC connectors are located under the instrument panel, to the right of the steering column bracket. See Figure 57 for terminal descriptions for the DLCs.

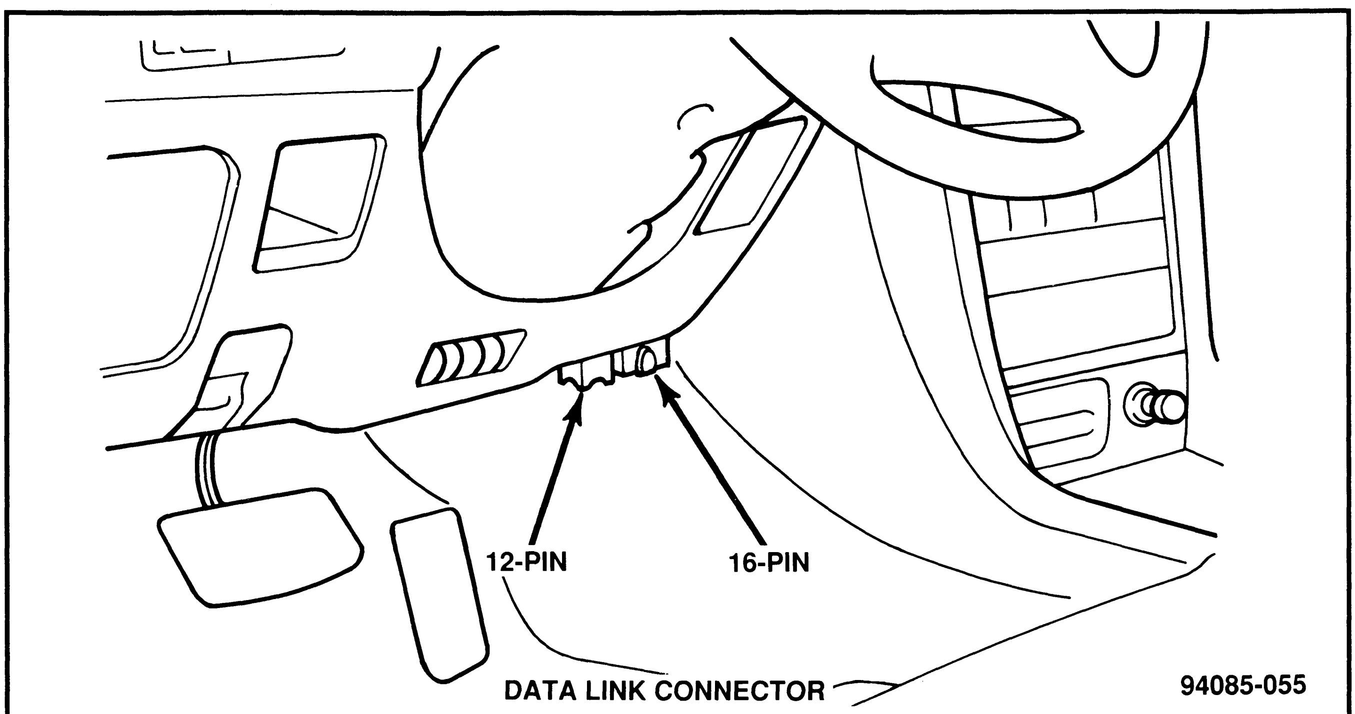
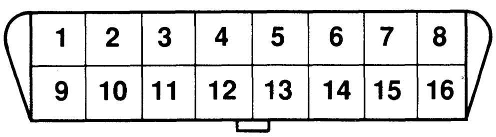


Figure 56 Data Link Connectors

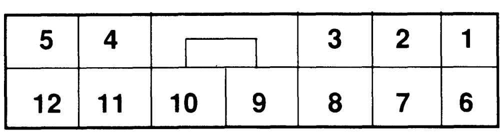
O B D - II connector
(16-pin, female)



Viewed from Terminal Side

No.	Use
1	Diagnostic control signal
2	(J1850 data link) * 1
3	Suspension control
4	Ground
5	Ground
6	Transmission control
7	ISO 9141-K data link ※ SCI-II TX
8	Brake control
9	Pulse signal diagnosis (ETACS)
10	(J1850 data link) * 1
11	Air conditioner control
12	SRS-Air bag control
13	Auto cruise control
14	Simulated vehicle speed signal
15	(ISO 9141-L data link) * 1
16	Battery power (DC 12V)

MMC CONNECTOR (Chassis side)



M M C connector
(12-pin, male)

Viewed from Terminal Side

No.	Use
1	Traction control (TCL)
2	Steering control (4WD or Tilt)
3	
4	
5	Fuel injection *2/※ SCI-II
6	※ SCI-II (EATX RX) '96 model
7	※ CCD bus (+) (TCM) '95 model
8	※ CCD bus (–) (TCM) '95 model
9	
10	
11	
12	

N O T E:

※ : Apply to Chrysler power plant.
* 1 : No wire on MMC & DSM vehicles.
* 2 : Apply to MMC SCI communication Engine.

94084-061

Figure 57 Data Link Connector Terminal Identification

Fuel Pump Relay

The fuel pump relay is located in the engine compartment, on the left side, attached to the bulkhead (fig. 58). The fuel pump relay is energized under the following conditions to provide power to operate the fuel pump:

- For approximately 0.5 - 5 seconds during the initial key-on cycle
- While the CKP sensor is providing an rpm signal that exceeds a predetermined value

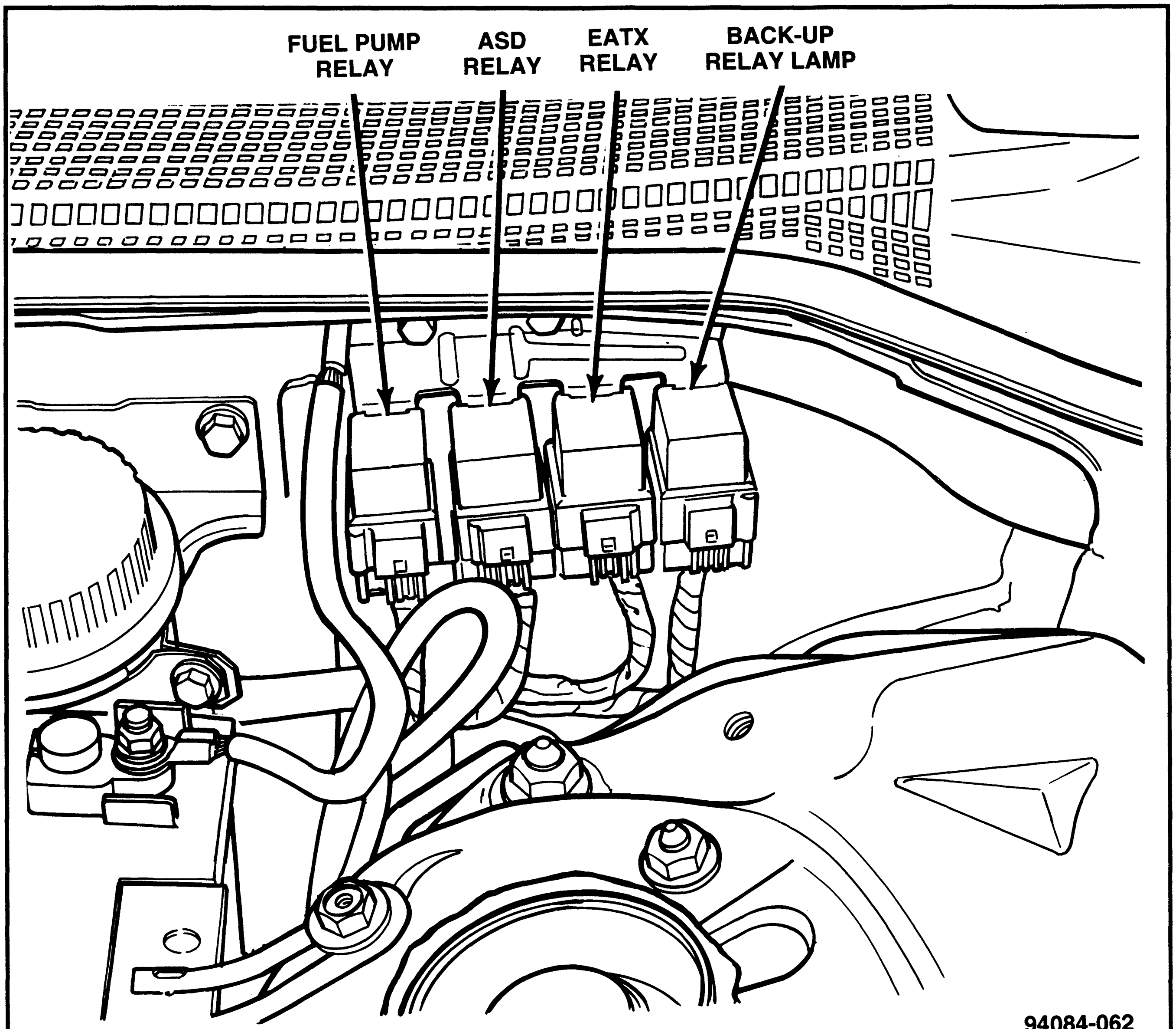


Figure 58 Fuel Pump and Auto Shutdown Relays

Ignition voltage is provided to the fuel pump relay's electromagnet any time the key is in the RUN position. The PCM provides the ground control to energize the relay through pin 38 (fig. 59). Unlike previous Chrysler systems, the fuel pump relay does not provide power to operate the O_2 sensor heater.

The relay is energized when the key is cycled to RUN in order to prime the fuel rail with liquid fuel, allowing for a quick start-up. Any time the Crankshaft Position sensor indicates that there is an rpm signal that exceeds a predetermined value, the relay is energized to ensure proper fuel pressure and volume during engine cranking and running conditions. Any time the Crankshaft Position sensor signal is lost (engine has been shut off or the sensor indicates no rpm), the fuel pump relay is de-energized.

Automatic Shutdown Relay (ASD)

The ASD relay is located on the bulkhead, next to the fuel pump relay (fig. 58). When energized, the ASD relay provides power to operate the injectors, ignition coil, generator field, O_2 sensor heaters (both upstream and downstream, if equipped), and also provides a sense circuit to the PCM for diagnostic purposes. The PCM energizes the ASD any time there is a Crankshaft Position sensor signal that exceeds a predetermined value. The ASD relay can be energized also after the engine has been turned off to perform an O_2 sensor heater test, if vehicle is equipped with OBD II diagnostics.

Unlike previous Chrysler products, the Talon's ASD relay's electromagnet is fed battery voltage, not ignition voltage. The PCM still provides the ground, but through pin 18 (fig. 59). As mentioned earlier, the PCM energizes the ASD relay during an O_2 sensor heater test. This test is performed only after the engine has been shut off. The PCM still operates internally to perform several checks, including monitoring the O_2 sensor heaters. This and other DTC tests are explained in detail in the On-Board Diagnostic Student Reference Book.

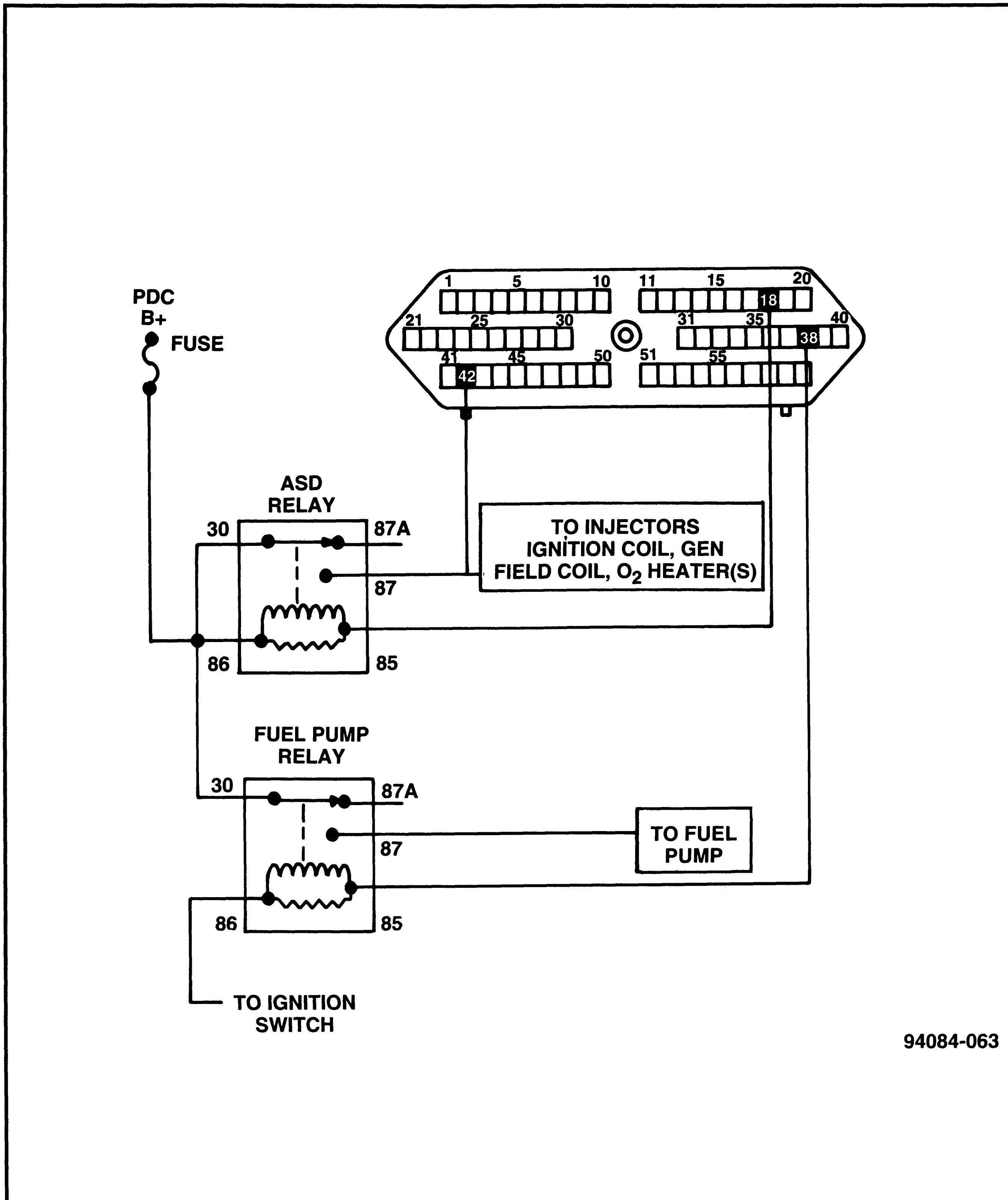


Figure 59 Fuel Pump and Auto Shutdown Relay Circuits

Ignition Coil

The PCM provides battery voltage to the ignition coil through the ASD relay. Coil operation is controlled by a ground path provided to each coil by the PCM. Ignition coil control for cylinders 1 and 4 is through PCM pin 21, and for cylinders 2 and 3, through pin 1 (fig. 60).

See the description of coil operation included in the Ignition System Components Section of this reference guide for further information.

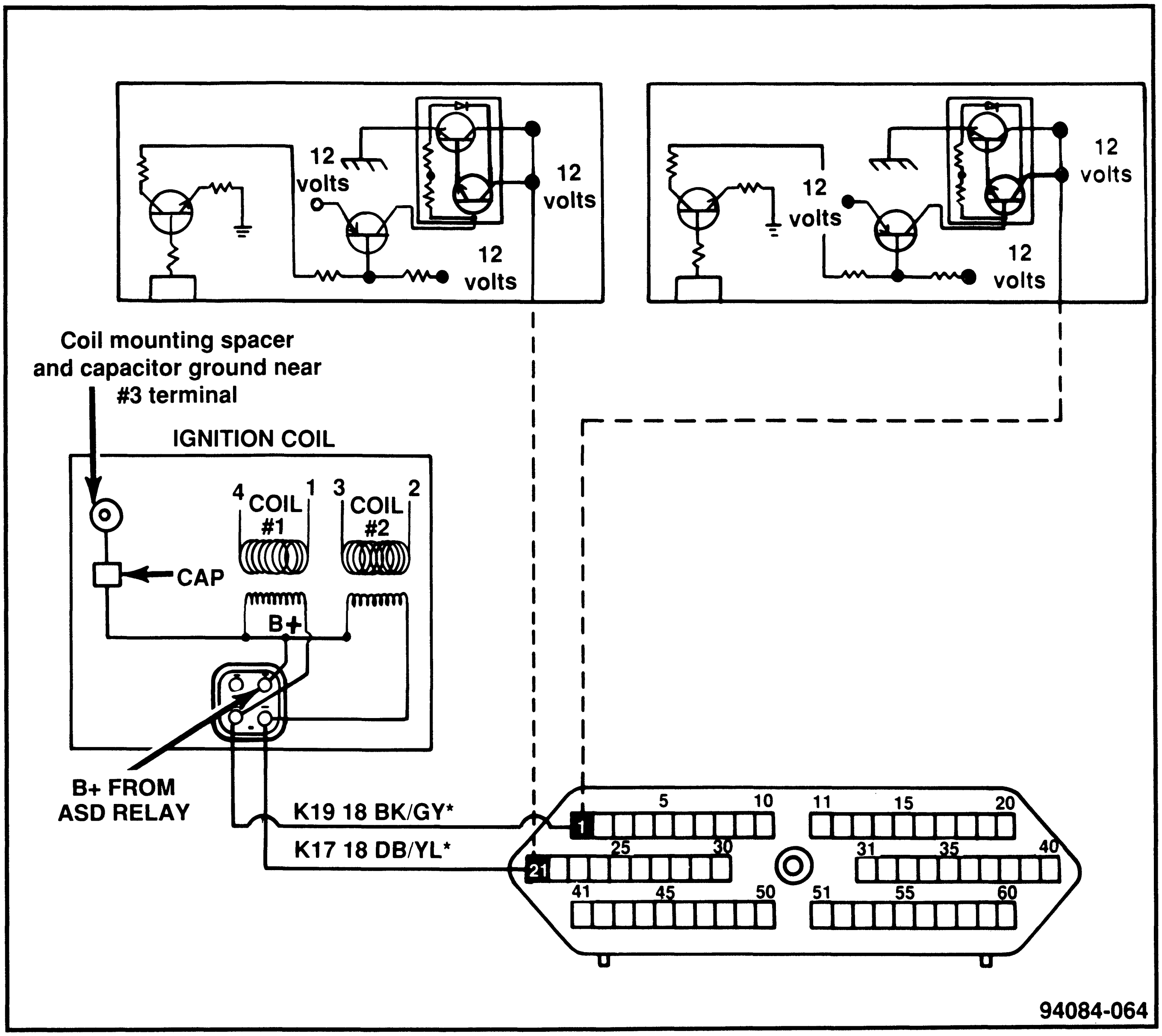


Figure 60 Ignition Coil Circuits

Fuel Injectors

The PCM provides battery voltage to each injector through the ASD relay (fig. 61). Injector operation is controlled by a ground path provided for each injector by the PCM. The PCM controls injector 1 through pin 4, injector 2 through pin 23, injector 3 through pin 3, and injector 4 through pin 24. Injector on-time (pulse-width) is variable, and is determined by the duration of the ground path provided.

See the description of fuel injectors in the Fuel System Components Section of this reference guide for further information.

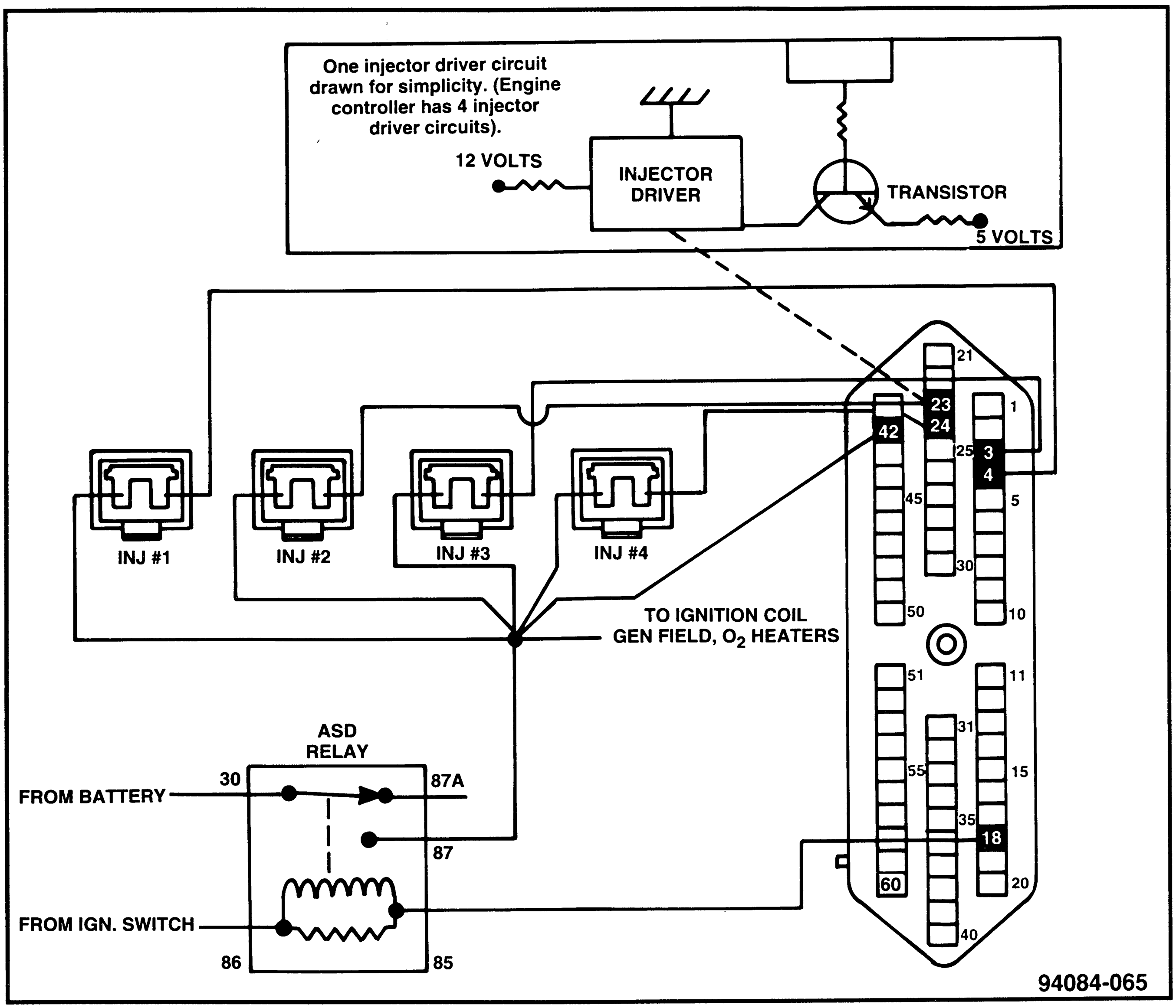


Figure 61 Fuel Injection Circuit

Idle Air Control (IAC) Stepper Motor

The IAC stepper motor is mounted to the throttle body, (fig. 62) and regulates the amount of air bypassing the control of the throttle plate. As engine loads and ambient temperatures change, engine rpm changes. A pintle on the IAC stepper motor protrudes into a passage in the throttle body, controlling air flow through the passage. The IAC is controlled by the PCM to maintain the target engine idle speed.

At idle, engine speed can be increased by retracting the pintle and allowing more air to pass through the port, or can be decreased by restricting the passage with the pintle and diminishing the amount of air bypassing the throttle plate.

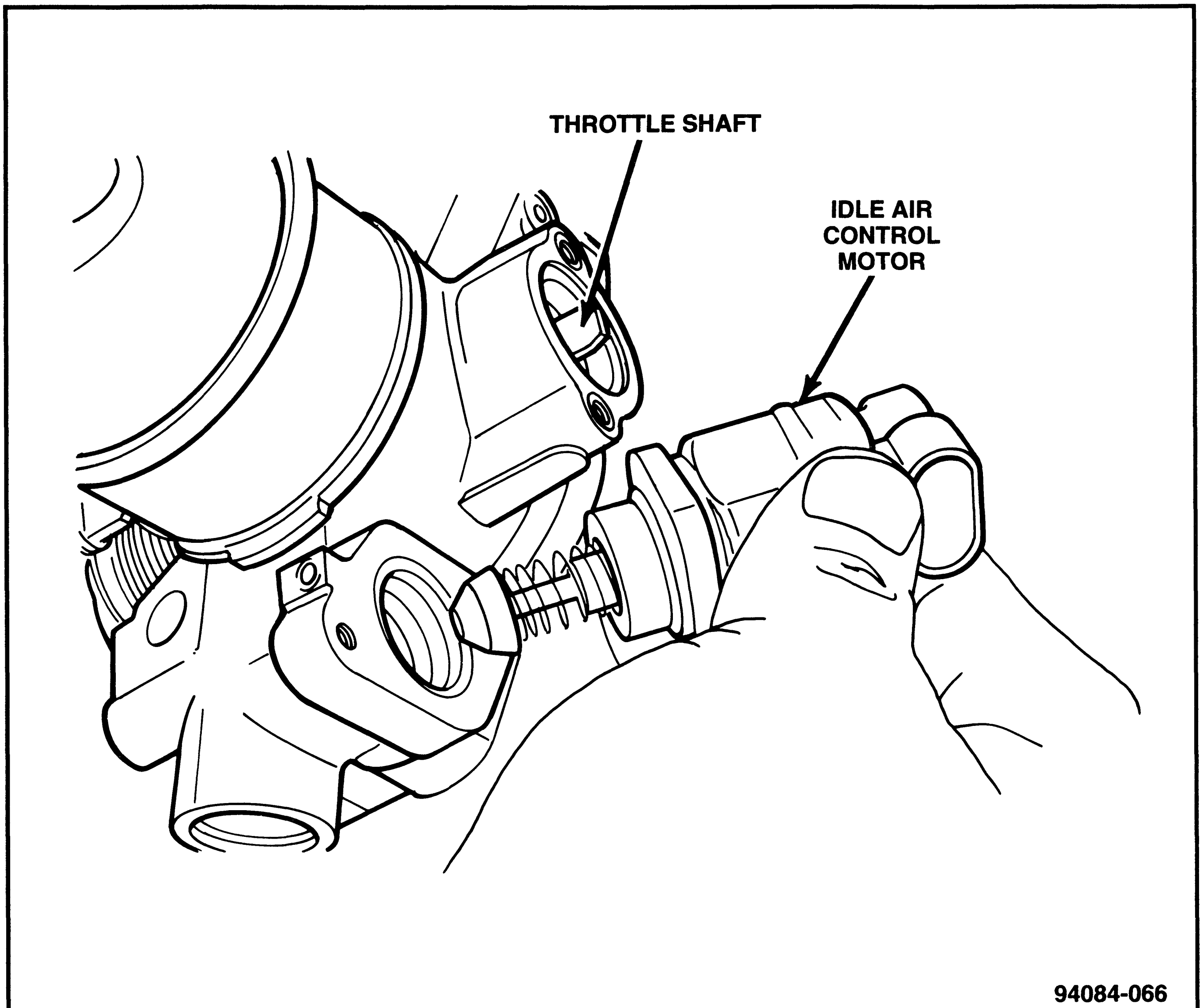


Figure 62 Idle Air Control (IAC) Stepper Motor

When engine rpm is above idle speed, the IAC is used for the functions listed below:

- Off-idle dashpot
- Deceleration air flow control
- A/C compressor load control (also opens the passage slightly before the compressor is engaged so that the engine rpm does not dip down when the compressor engages)
- Power steering load control

The PCM controls the IAC stepper motor through pins 14, 15, 35, and 41 (fig. 63). The PCM can control polarity of the circuit to control direction of the stepper motor.

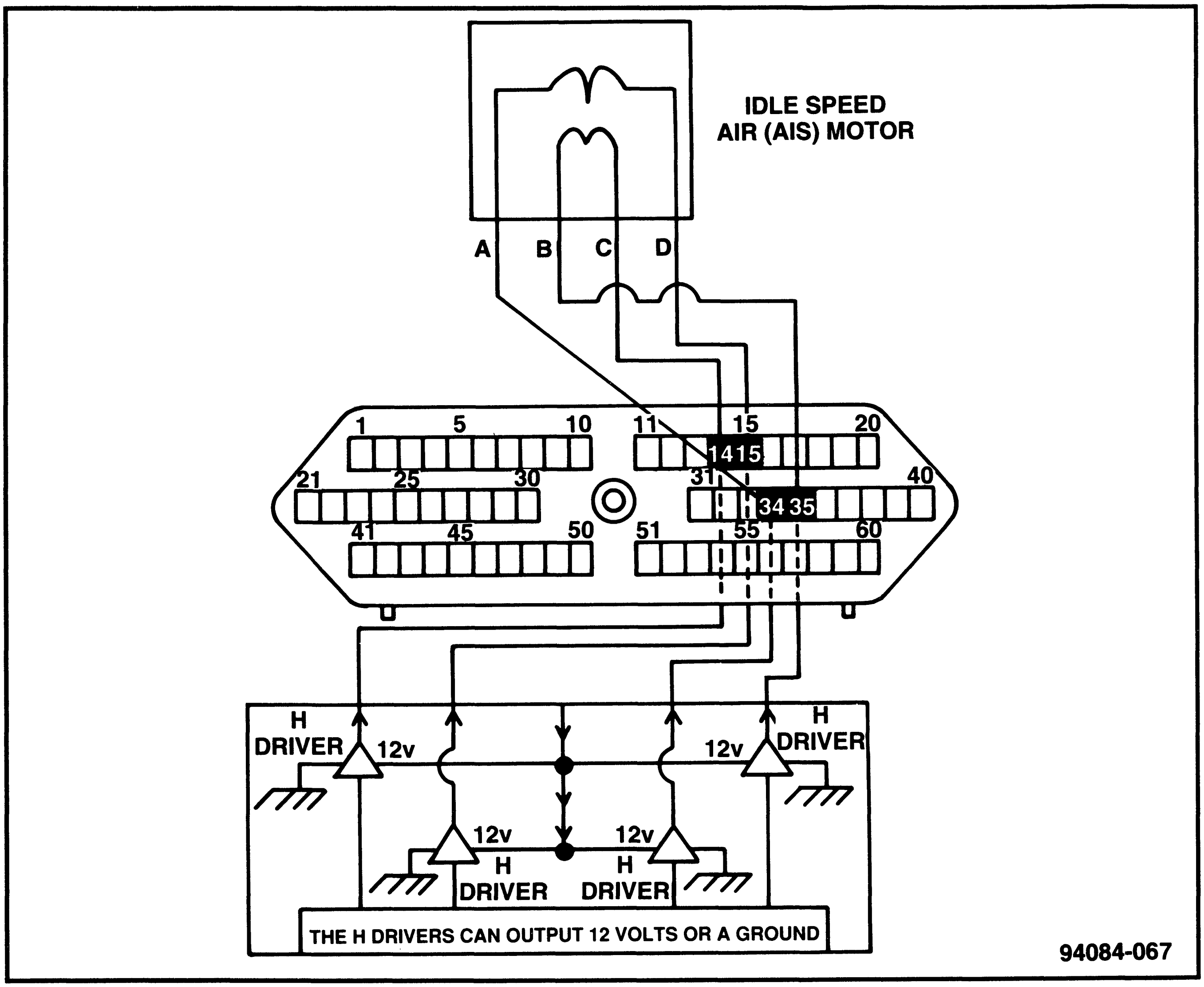


Figure 63 Idle Air Control Circuits

IAC Stepper Motors Program

When the pintle has completly blocked the air passage, the IAC stepper motor is at step 0. The PCM has the authority to increase the opening by approximately 180-200 steps. The IAC stepper motor cannot identify in exactly which position the pintle is, so the PCM has a program that enables it to learn the position of the IAC pintle.

The program begins by learning step 0. This is accomplished by the PCM's driving the IAC stepper motor closed for several seconds when the key is first turned to the RUN position. The PCM assumes that, at the end of the cycle, the IAC stepper motor should be at step 0. Once the stepper motor finds step 0, the PCM backs the motor to the open position. The number of steps needed to arrive at the open position is based upon information delivered by the ECT sensor. The program can be updated by the DRB III or by disconnecting battery voltage from the PCM, and then reconnecting it.

The PCM is also equipped with a memory program that records the number of steps the IAC stepper motor most recently advanced to during a certain set of parameters. For example: The PCM was attempting to maintain a 1000 rpm target during a cold start-up cycle. The last recorded number of steps for that may have been 125. That value would be recorded in the memory cell so that the next time the PCM recognizes the identical conditions, the PCM recalls that 125 steps were required to maintain the target. This program allows for greater customer satisfaction due to greater control of engine idle.

Another function of the memory program, which occurs when the power steering switch or the A/C request circuit requires that the IAC stepper motor control engine rpm, is the recording of the last targeted steps into the memory cell. As mentioned earlier, the PCM can "anticipate" compressor loads. This is accomplished by delaying compressor operation for approximately 0.5 seconds until the PCM moves the IAC stepper motor to the recorded steps that were loaded into the memory cell. Using this program helps eliminate idle-quality changes as loads change.

IAC Stepper Motor Service

Any time the IAC stepper motor or its circuit is serviced, the IAC memory cell must be updated. Use the DRB III to "Reset IAC." This ensures that the PCM can identify step 0. Also, be sure that when the IAC stepper motor is installed into the throttle body, the pintle does not protrude too much. Measure the distance between the motor base and the pintle tip to ensure that the distance does not exceed 1 in. Refer to the Service Manual when replacing the IAC stepper motor.

Secondary Air Injection

To meet emissions standards, Talons with a manual transaxle require the use of an air injection system called "secondary air injection." In order to quickly warm the catalytic converter, air is injected upstream of the catalytic converter. The added oxygen allows for a quick temperature rise in the converter during warm-up cycles.

The PCM controls the secondary air solenoid through pin 20 by providing a path to ground during the warm-up cycle. The warm-up cycle conditions are as follows:

- Engine must be running
- ECT sensor indicates a temperature less than 120°F - solenoid is energized for 115 seconds after the start-to-run transfer
- ECT sensor indicates a temperature greater than 120°F - solenoid is energized for 19 seconds after the start-to-run transfer
- ECT sensor indicates a temperature between 140° - 154°F - solenoid is energized during the deceleration mode only

Air Conditioning Clutch Relay

The air conditioning clutch relay is located in the PDC. The PCM provides the ground path for the relay coil through pin 59. Relay operation is based on inputs the PCM receives from the air conditioning sense circuit. The PCM deactivates the relay at vehicle start-up. This temporarily reduces the accessory load on the engine. (See page 69 for additional information.)

Exhaust Gas Recirculation (EGR) Transducer

The EGR valve and back-pressure transducer are located at the rear of the cylinder head, near the CMP sensor. The EGR solenoid is attached to the transducer, and controls the supply of vacuum to the EGR transducer. The transducer is attached to the exhaust supply, and controls the supply of vacuum to the EGR valve. The valve is fed exhaust gases from the exhaust manifold, and routes the gases to the intake manifold.

The PCM provides a ground path through pin 69 that operates the solenoid on the EGR transducer (fig. 64). When the solenoid is energized, manifold vacuum is not allowed to reach the transducer. De-energizing the solenoid allows vacuum to flow to the transducer, and with appropriate back pressure, the transducer vent closes. This allows vacuum to reach, and open, the EGR valve.

Some of Chrysler,s EGR back-pressure transducers contain a light spring-load to assist in the opening of the transducer valve. The EGR transducer on the 2.0L DOHC engine does not contain a spring to open the vent inside the transducer (fig. 65). This means that the valve may close off the vent when there is no back-pressure. This transducer valve opens the vent only by the negative back-pressure in the exhaust system. For proper EGR valve operation, the position of the valve is critical. The transducer hose that attaches it to the exhaust supply should always be facing down. This allows gravity to assist in opening the valve when appropriate.

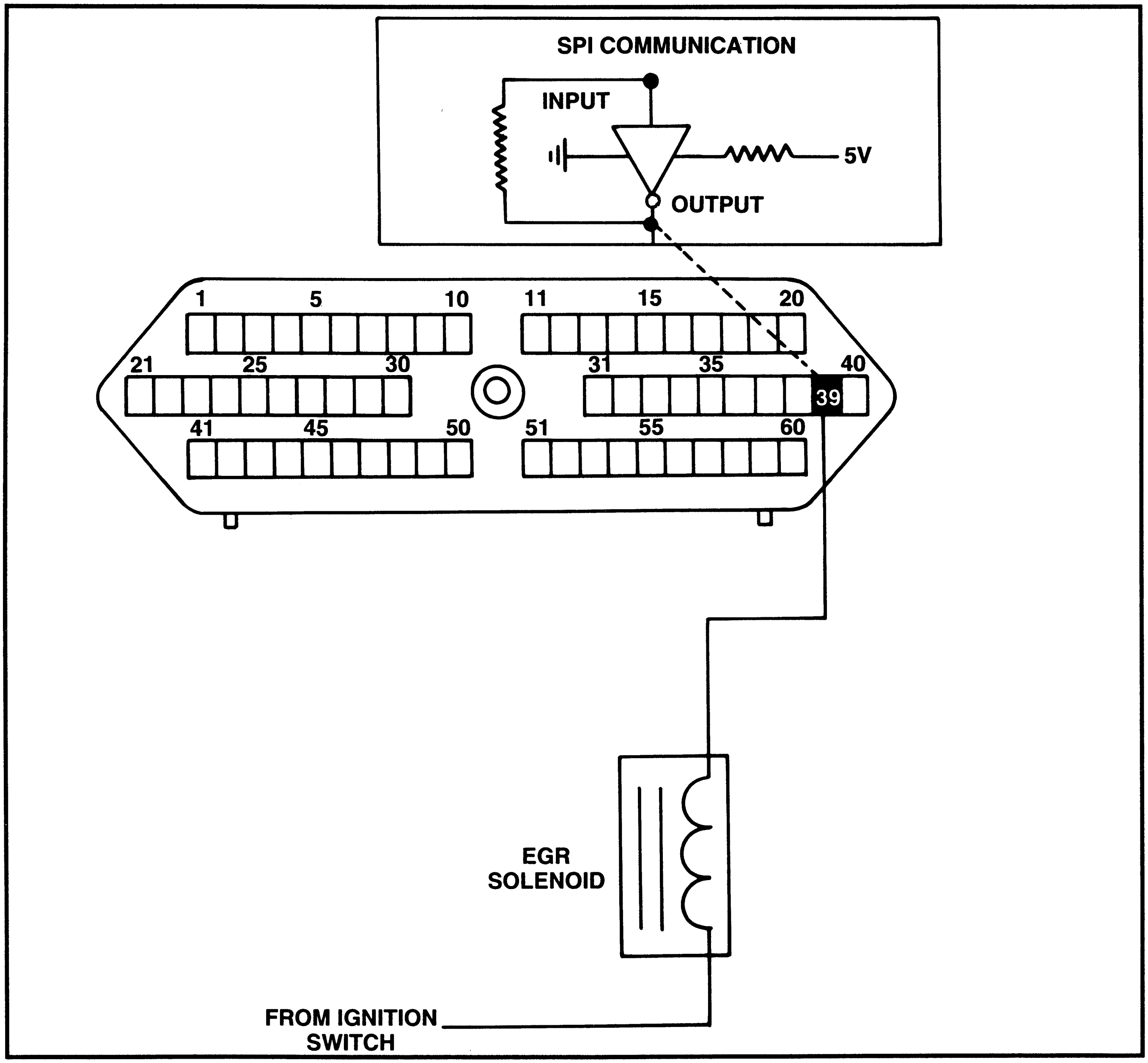


Figure 64 EGR Solenoid Circuit

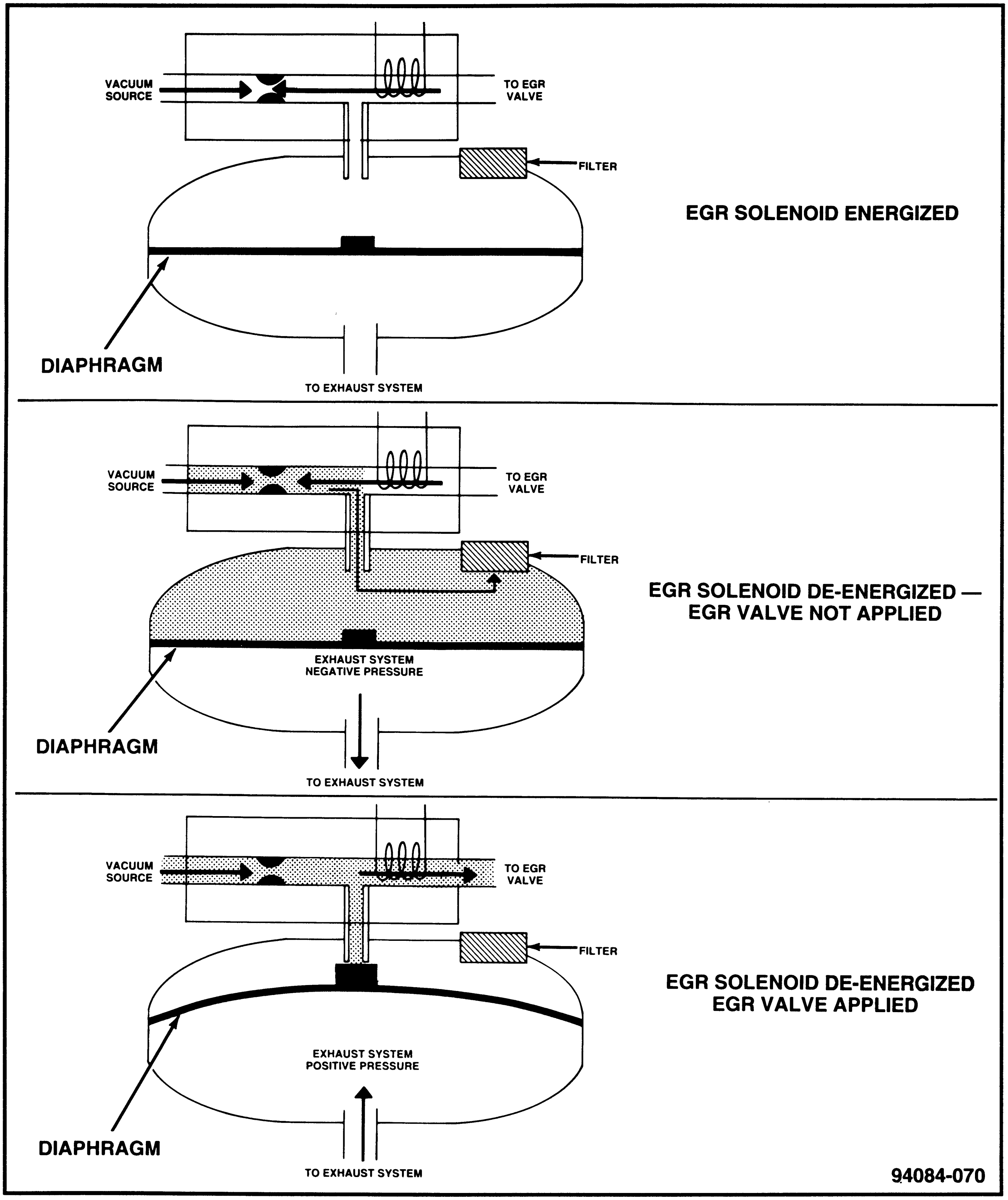


Figure 65 EGR Transducer

Radiator/Condenser Fan Relay

The radiator and condenser fan relays are located in the Power Distribution Center (PDC), in the engine compartment. The 2.0L engine with a manual transaxle uses an 85W single-speed radiator fan motor, whereas the automatic transaxle version uses a two-speed 120W motor. The PDC contains two radiator fan relays, one for HI speed fan operation, and one for LO speed fan operation. The PCM operates the relays based upon inputs from the ECT sensor, the VSS, and the A/C system.

On vehicles with automatic transaxles, the two-speed radiator fan motor is equipped with four fan-motor brushes, two connected to the vehicle ground, one connected to the LO speed relay, and one connected to the HI speed relay.

To achieve two fan speeds, the PCM energizes either the LO speed relay to provide LO speed, or both relays to provide HI speed. The PCM supplies the ground circuit for the LO speed fan relay's electromagnet through pin 19, and for the HI speed fan relay electromagnet through pin 57 (fig. 66).

Battery voltage is provided to the fan relays' contacts by a 30 amp fuse located in the PDC. When the PCM energizes the LO fan speed relay, current flows through the contacts of the relay to the fan motor's LO speed brush, providing LO speed operation of the fan motor. HI speed is accomplished by the PCM's energizing both the LO speed and the HI speed relays. When this occurs, current flows to both LO speed and HI speed fan motor brushes.

The condenser fan motor operates similar to the radiator fan motor. Talons equipped with either manual or automatic transaxles use a two-speed condenser fan motor. The condenser fan motor is controlled by two relays, a LO speed relay and a HI speed relay. Both relays are located in the PDC.

The LO speed relay's electromagnet is provided battery voltage by the A/C switch and is grounded continuously. The HI speed fan motor relay's electromagnet is fed battery voltage through a fuse, and the ground side is controlled by the PCM through pin 57 which is the same pin as the HI speed radiator fan motor relay's circuit (fig. 66).

Battery voltage is provided to both of the relay contacts through a fuse, located in the PDC. When all of the appropriate inputs to the automatic A/C control module indicate that the A/C compressor should be functioning, battery voltage is supplied to the condenser fan motor's LO speed relay. When the relay is energized, current flows through the relay contacts to the condenser fan motor's LO speed brush. If HI speed is desired, the PCM energizes the HI speed fan relay. When this occurs, current flows to both the LO speed and HI speed brushes. (Refer to Table 6 for conditions to energize and de-energize the radiator and condenser fan relays.)

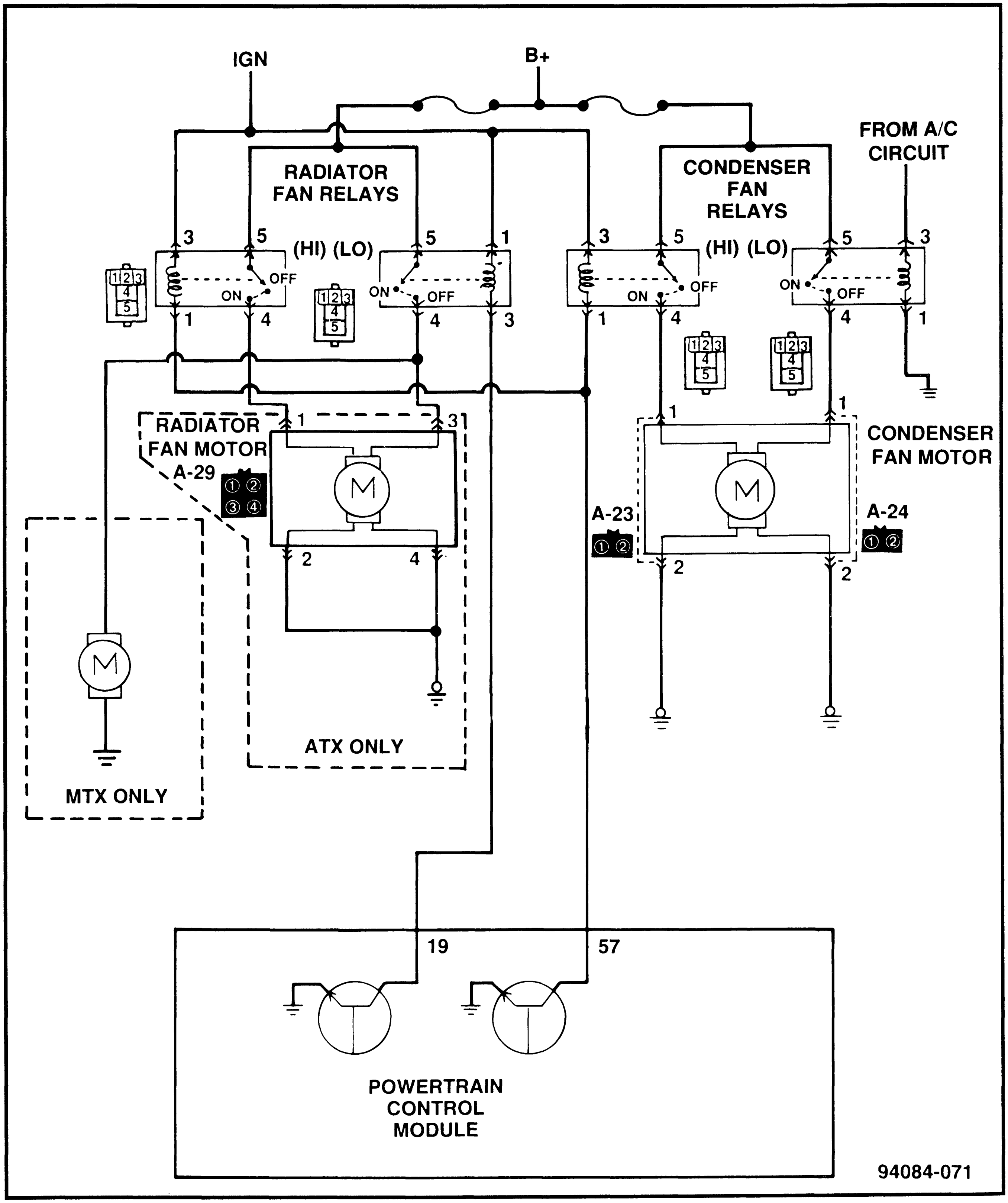


Figure 66 Radiator Fan Relay Circuits

Table 6 Radiator and Condenser Fan Operation

A/C SWITCH POSITION	VEHICLE SPEED	ENGINE COOL. TEMP	LO FAN RELAY	HI FAN RELAY	A/C COMP.	RAD. FAN SPEED	COND. FAN SPEED
OFF	0-28 mph	Under 203°F	OFF	OFF	OFF	OFF	OFF
		203°F to 212°F	ON	OFF	OFF	LOW	OFF
		Over 212°F	ON	ON	OFF	HI	LOW
	28-50 mph	Under 203°F	OFF	OFF	OFF	OFF	OFF
		203°F to 212°F	ON	OFF	OFF	LOW	OFF
		Over 212°F	ON	ON	OFF	HI	LOW
	Over 50 mph	Under 212°F	OFF	OFF	OFF	OFF	OFF
		Over 212°F	ON	ON	OFF	HI	LOW
ON	0-12 mph	Under 212°F	ON	OFF	ON	LOW	LOW
		212°F to 239°F	ON	ON	ON	HI	HI
		Over 239°F	ON	ON	CUT	HI	HI
ON	12-28 mph	Under 212°F	ON	OFF	ON	LOW	LOW
		212°F to 239°F	ON	ON	ON	HI	HI
		Over 239°F	ON	ON	CUT	HI	HI
	Over 50 mph	Under 212°F	OFF	OFF	ON	OFF	LOW
		212°F to 239°F	ON	ON	ON	HI	HI
		Over 239°F	ON	ON	CUT	HI	HI

Manual transaxle radiator fan operation (single speed motor) - LOW = HI

Speed-Control Servo

The speed-control servo and relay are located in the engine compartment, and are attached to the right side bulkhead (fig. 67). The speed control vacuum and vent solenoids, located inside the servo, are operated by the PCM through pins 40 and 60 (fig. 68). The PCM provides a ground path for the vent and vacuum solenoids during speed control operation. Any time the brakes are applied, power and ground for the solenoids are removed. When the brake is released, ground for the vent and vacuum circuits is restored only when the RESUME switch has been set.

The brake switch energizes the speed control relay causing the contacts to open when the brakes are applied. The ON/OFF switch in the ON position supplies power to the relay's contacts. Power is removed when the OFF button is pressed or the brakes are applied.

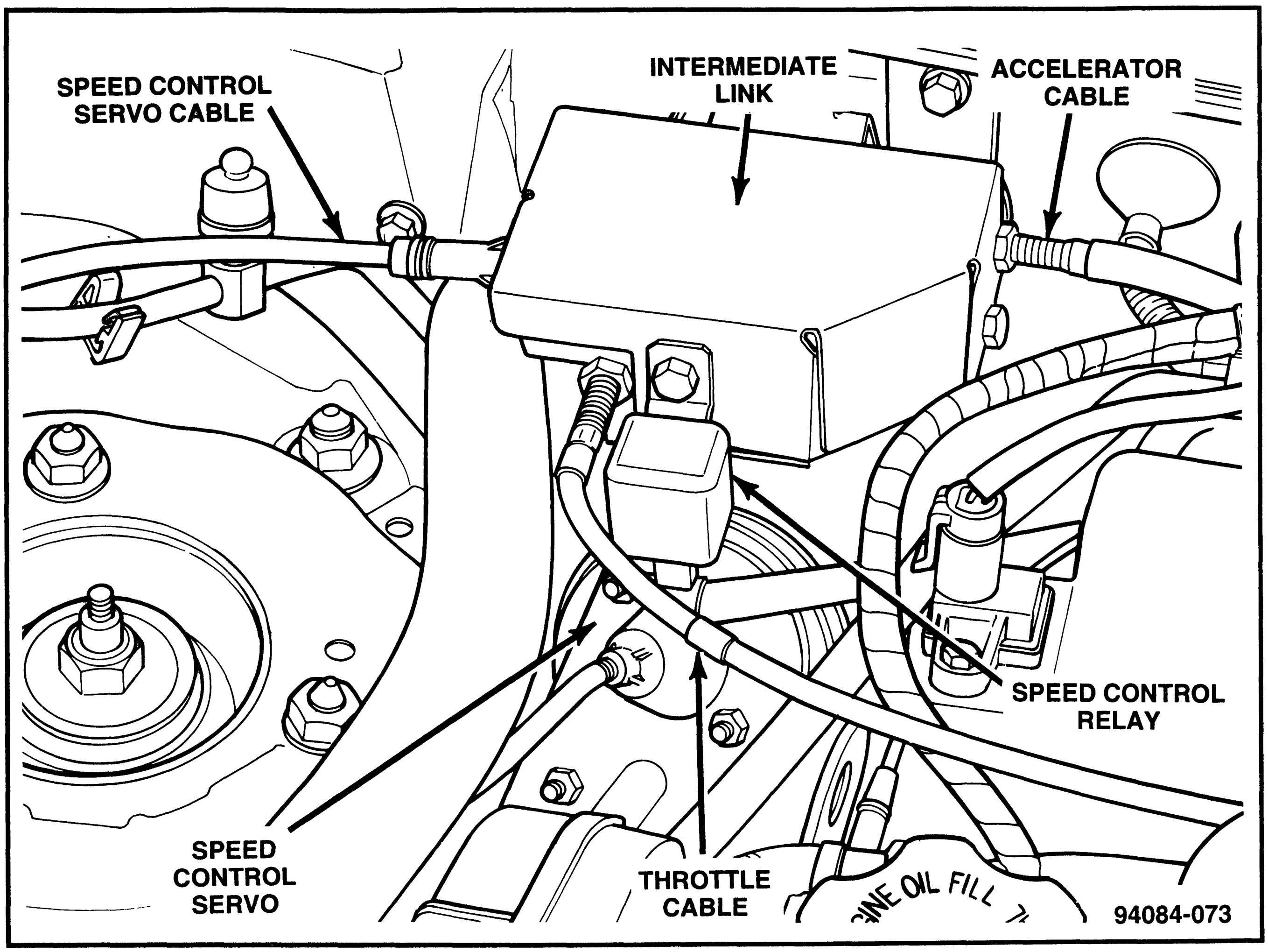


Figure 67 Speed Control Servo and Relay

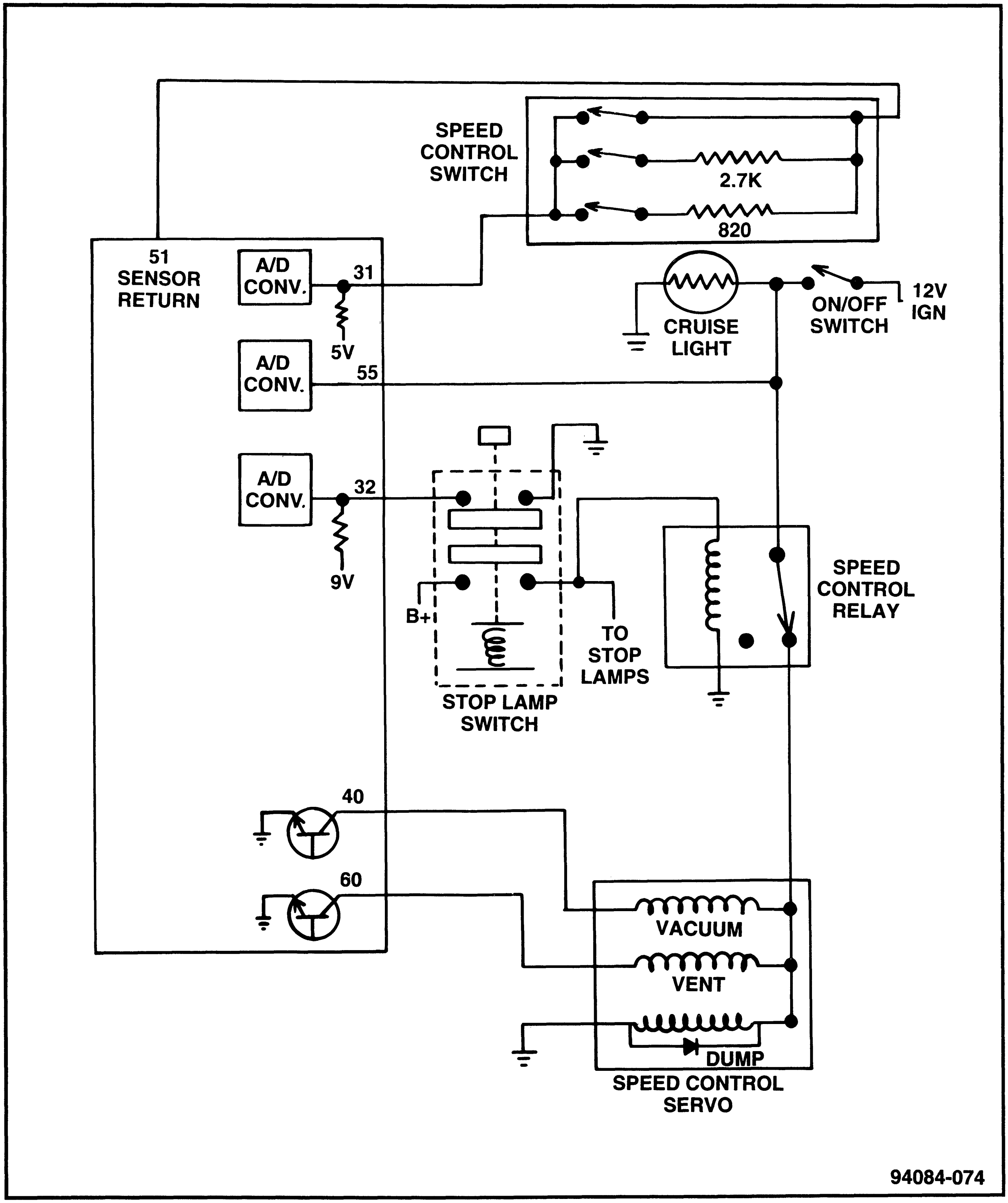


Figure 68 Speed Control Circuit

Intermediate Link

The intermediate link is used to operate the throttle from both the accelerator pedal and the speed control servo. The mechanism is designed so that when speed control is activated, the throttle can be opened or closed by the servo without moving the accelerator pedal, or when the speed control is off, moving the accelerator pedal does not cause the cable at the servo to move (fig. 69).

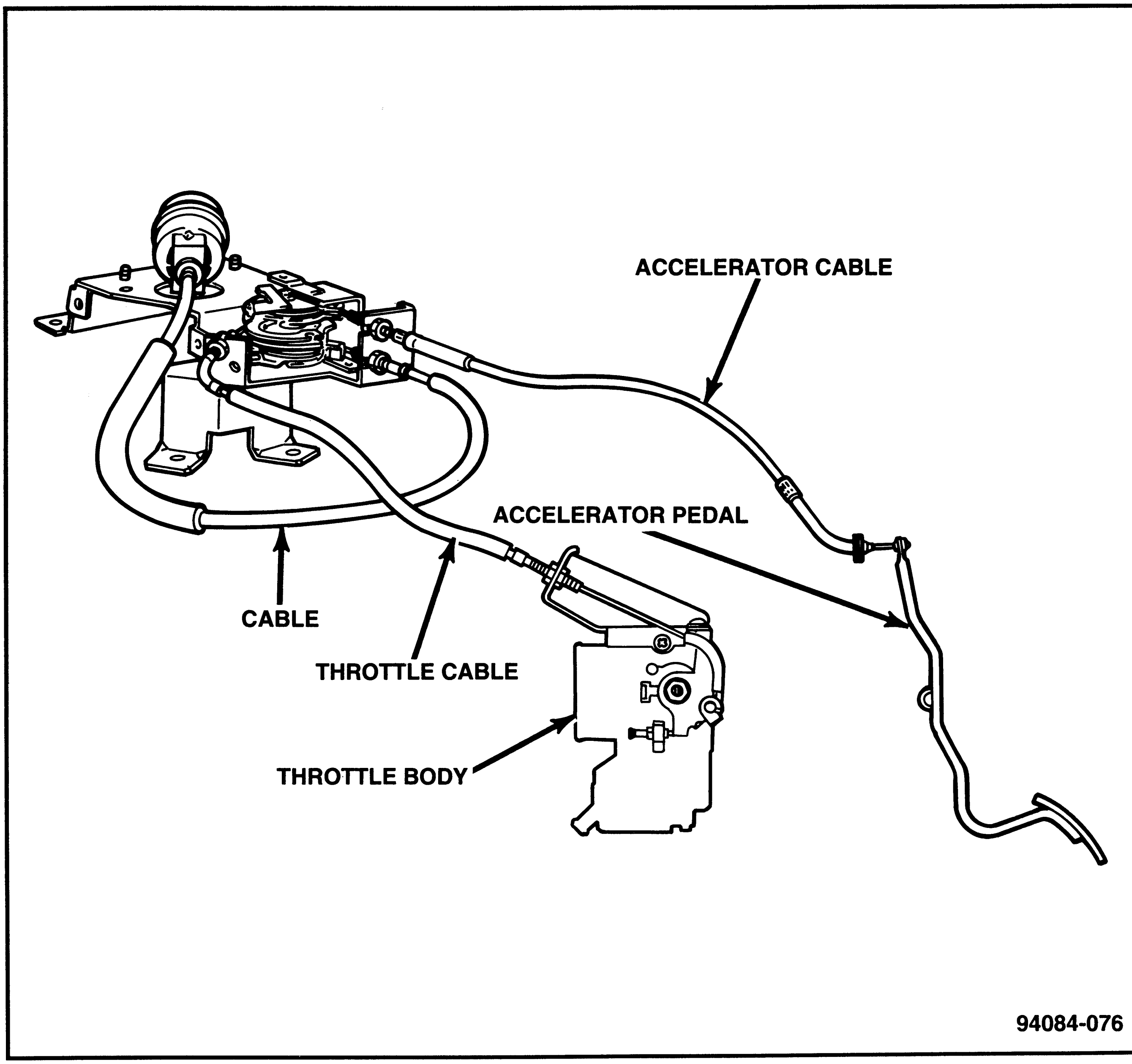


Figure 69 Intermediate Link

During driving with the speed-control engaged, the speed control servo's cable pulls on link C (fig. 70). As link C rotates, a tab pushes against link B, causing the throttle cable to move. This action not only opens the throttle plate, but also relieves tension on the accelerator cable so that the accelerator pedal does not move.

With the speed control disengaged, the accelerator cable pulls on link A (fig. 71). A tab on link A contacts a tab on link B when the cable is pulled. This allows the throttle cable to open the throttle plate, and yet causes no tension on the speed-control servo cable.

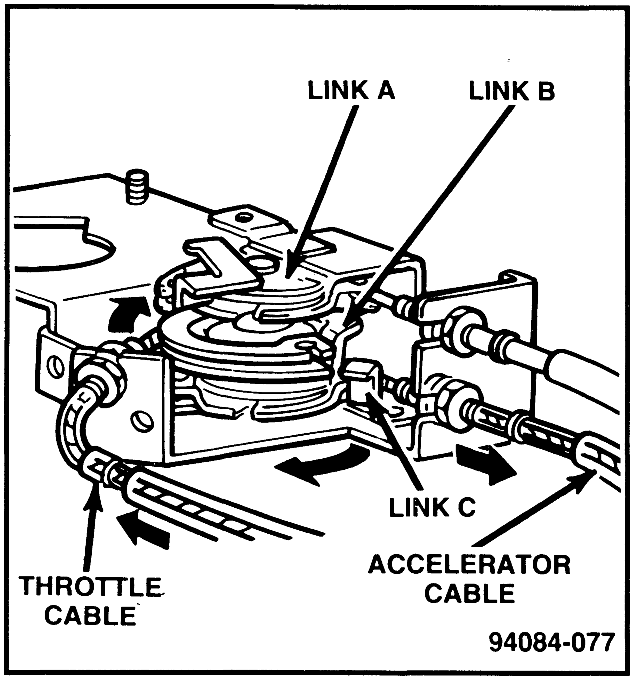


Figure 70 Speed Control Engaged

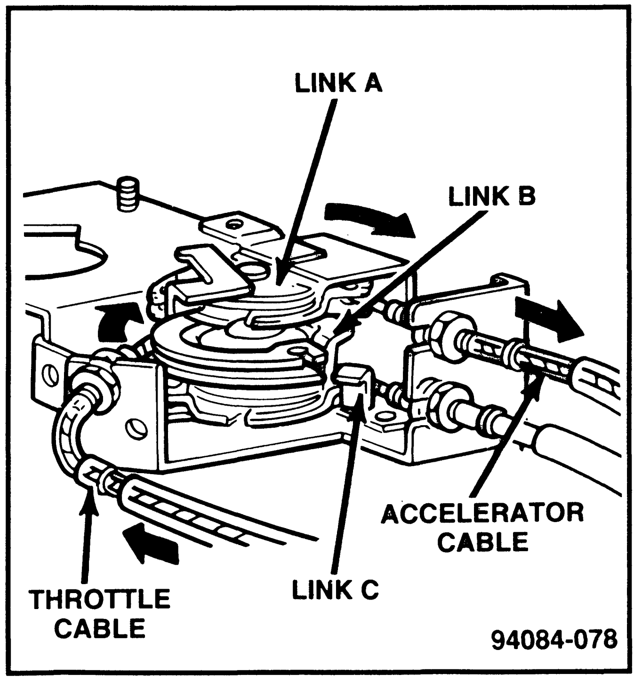


Figure 71 Speed Control Dis-engaged

2.0L DOHC Non-Turbo Fuel & Ignition

Tachometer

The PCM operates the tachometer located on the instrument panel, calculating engine speed based upon input from the CKP sensor. The PCM provides duty-cycled output voltage to the tachometer, based upon engine speed through pin 48 (fig. 72).

Charging System Indicator Lamp

The PCM controls operation of the charging system indicator lamp, located in the vehicle's instrument cluster. The PCM provides a ground to complete the lamp circuit if the charging output falls below a specified threshold (fig. 72).

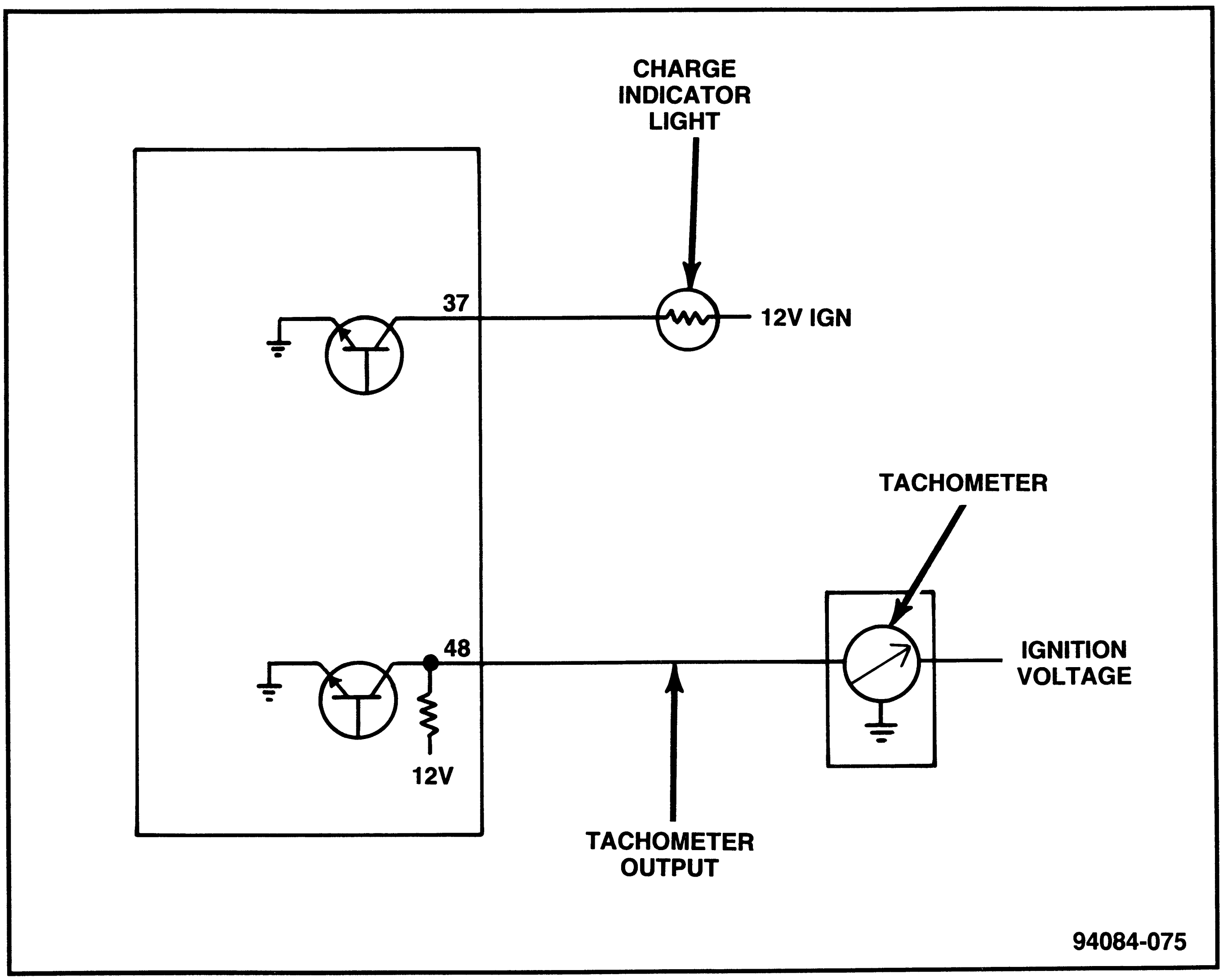


Figure 72 Tachometer and Charge Indicator Lamp Circuit

Generator

The PCM is responsible for maintaining the charging system's voltage between 12.9-15.0 volts. The voltage determined by the PCM as the final goal for the charging system is called "target charging voltage." The target charging voltage is controlled mainly by the battery temperature sensor, which is located in the PCM.

The PCM controls the generator output by manipulating the ground side of the field winding through pin 41 of the PCM (fig. 73). A circuit in the PCM cycles the ground side of the generator field 100 times per second, but has the capability to ground the field control wire 100% of the time (full field) if the target voltage cannot be achieved.

The PCM monitors battery voltage through pin 11 (fig. 73). If the monitored voltage is lower than the target voltage, the PCM increases the duty cycle. If the target voltage is lower than the output voltage, the PCM decreases the duty cycle. If the charging rate cannot be monitored, a duty cycle of 25% may be used in order to have some generator output.

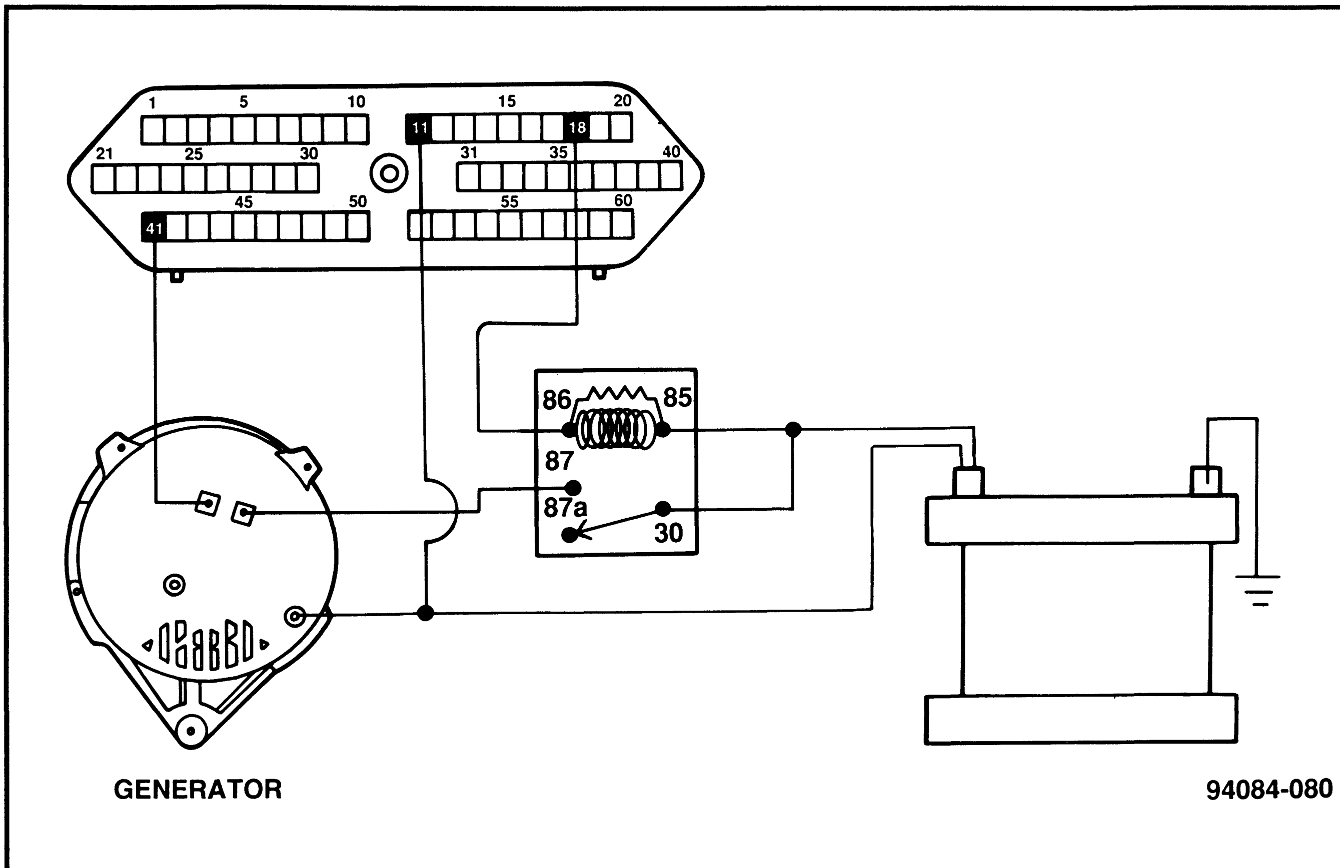
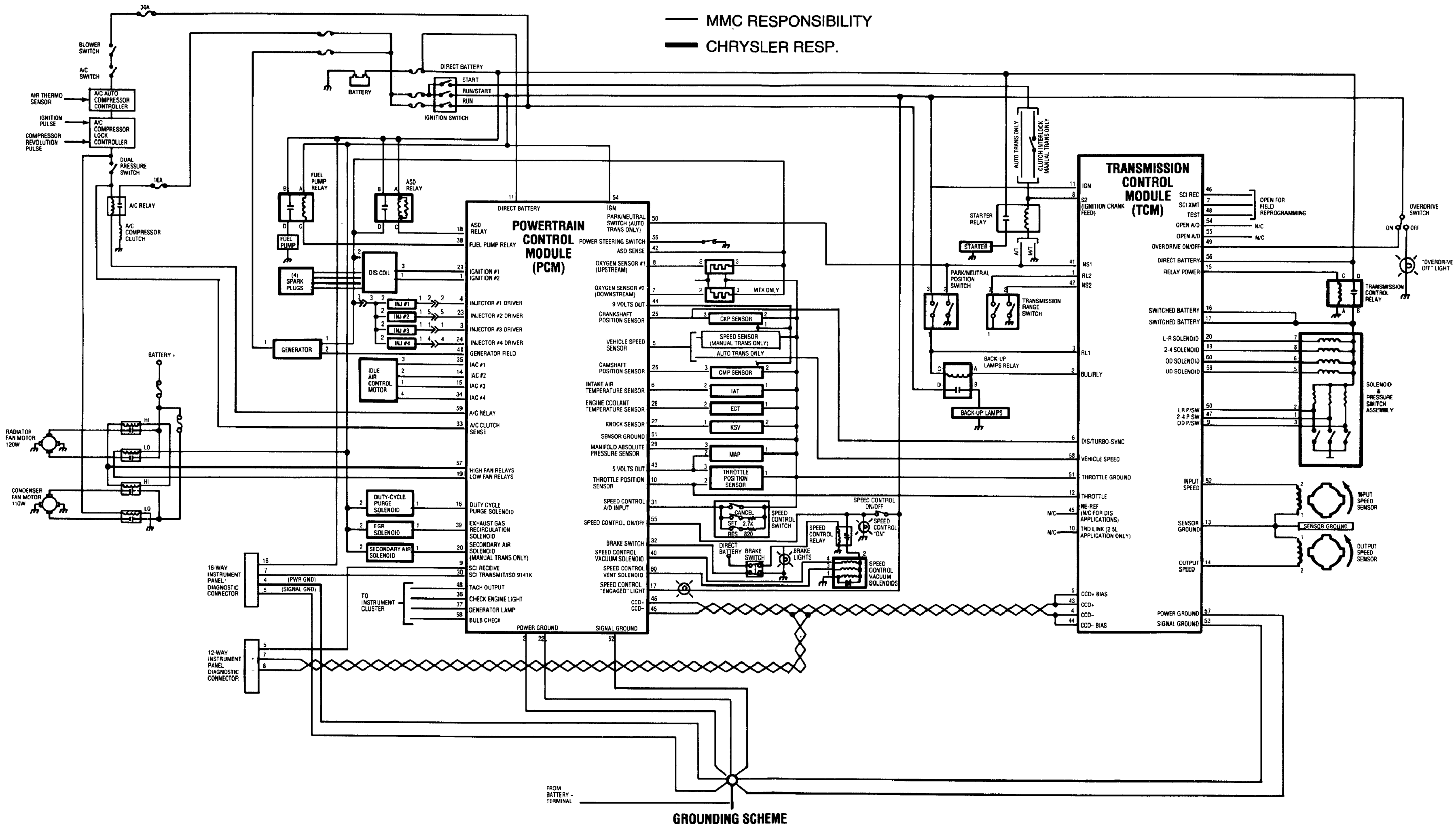


Figure 73 Generator Circuit

ELECTRONIC CONTROL SYSTEM (2.0L ENGINE - F4AC1 TRANS)



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Training Center Manager
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Hazelwood, Missouri 63042

KANSAS CITY (Zone Trng Ctr)
Training Center Manager
Lenexa Industrial Park
13253 West 98th Street
Lenexa, Kansas 66215

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